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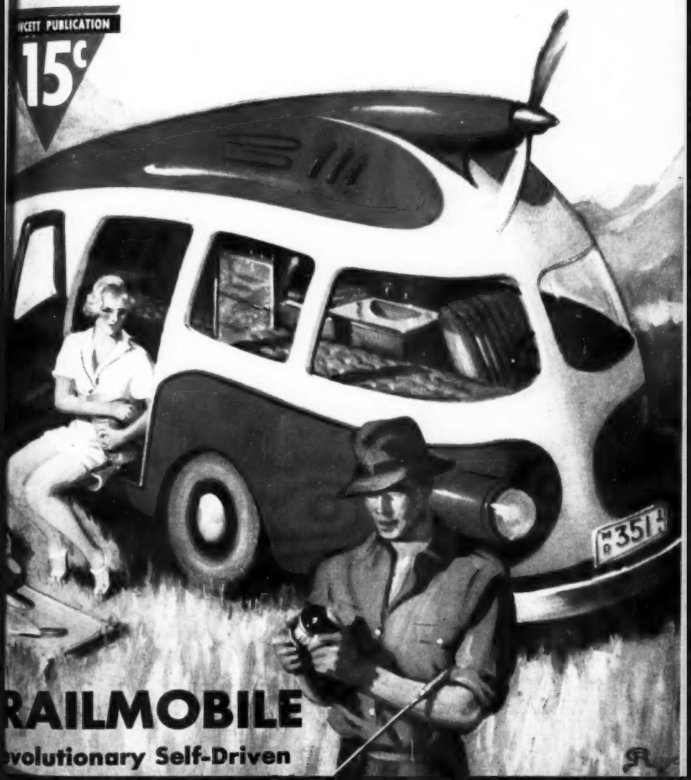

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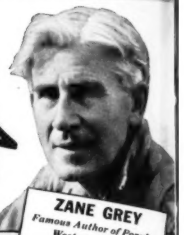

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SEPTEMBER 1937

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SPECIAL FEATURES

The Trailmobile, Revolutionary Self-Driven Trailer Home - - - - - - - - **36**

By Frederick C. Russell

Science Builds Greatest Telescope - - - **44**

By John Edwin Hogg

Mechanical Artists Blow Glass Bottles - - **58**

By Harold L. Zimmer

He Was An Inventor At 10! - - - - - **60**

By Robert Hertzberg

Shelter Tents For The Hiker - - - - **64**

By Robert Page Lincoln

Stamps For Specialists - - - - - - **70**

By Beach Conger

Visit New Worlds With A Home Microscope Part One - - - - - - - - - - **102**

By Julian D. Corrington

(*Continued on page 8*)

NEXT MONTH

In all the world there is only one plan where playing with fire has been made a paying proposition — the Underwriters' Laboratories in Chicago, Ill. Here, in order to test the effectiveness of fire fighting equipment before certifying as to its efficiency, more fires are deliberately started daily than occur normally during a month in any major sized city. H. H. Slawson tells all about it in a fascinating article—"Where Playing With Fire Pays."

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Among the many interesting projects included in the October issue will be—Improving Aerials and Grounds; A Stamp File for Collectors; Building a Colonial Arm Chair; Interesting Science Experiments; and a host of other plans, suggestions, and practical workshop kinks that will supply ample outlet for your craftsmanship.

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Remember that for every Edison or Kettering, for every McCormick, DeForest or Atwater Kent—there have been thousands of unknown men whose inventions helped along the wheels of progress and helped the inventors financially at the same time.

Many Little Ideas Have Big Commercial Possibilities

For example, who knows the name of the inventor of the wooden golf tee, the ordinary crinkly hair pin, or the metal ball or disc that the average housewife uses for scouring pots and pans? Who knows the inventor of the thousands of gadgets that you will find in the ten-cent stores, in the modern drug and department stores? Some day, stop and look at some of the simple articles you'll find on the counters of a ten-cent store. Notice how many of them are marked Patented or Patent Applied For. It is an interesting, educational experiment. These inventors, most of them, weren't of the genius class. They simply got an idea for doing something in a better, easier, faster, or more economical way—AND THEN DID SOMETHING ABOUT IT.

Interesting • *Points*

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Ans.: Miss Beulah Louise Henry of New York City leads all women inventors, holds fifty patents; is known as "Lady Edison".

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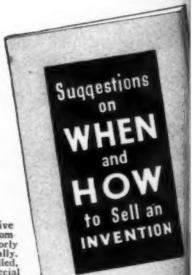

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NOTE ★ ★

You may not be an Edison or a Kettering but still you may have a good idea

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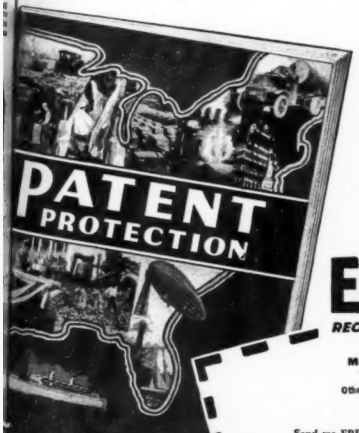

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CONTENTS—Continued from page 4

SHORTER FEATURES

Windmills For Steam—Frontispiece - - - 35
From Model To Air Liner - - - - - - - 42
They're All Riding Scooters - - - - - 52
Aerial Freighters Serve Miners - - - - 56
W3XFE Transmits On All Wavelengths - - 62
Cardboard Flying Models Produced In England - - - - - - - - - - - - - 68
Inventors In The News - - - - - - - - 115

HOW-TO-BUILD FEATURES

Tricks With Matches - - - - - - - - - 74
"Dutch Duck Railway" Provides Fun And Profit - - - - - - - - - - - - - - 76
Modern Design For An Ancient Lamp - - 77
How To Clean And Condition Your Firearms 78
An Old Fashioned Doorbell - - - - - - 83
Scan The Skies With This Powerful Home-Made Telescope—Part Two - - - - - 84
"Tiny Tot"—Companion Set To ¾-Meter Transmitter - - - - - - - - - - - 90
"Tinker"—A Midget Metal Hull Dinghy - - 92
Metal Humidor Combines Pipe Rack - - - 98
How To Take Proper Care Of Your Home Furniture - - - - - - - - - - - - - 100
Electric Cutter Makes Phonograph Record Novelties - - - - - - - - - - - - 105

NEW MECHANICAL INVENTIONS

"Atom-Smasher" Creates 100-Million-Mile Speeds - - - - - - - - - - - - - - 41
New Garbage Can Foils Dogs - - - - - - 41
Device Awakens Sleeper With Water In The Face - - - - - - - - - - - - - - 50
Portable Lorry Loader Hoists Loads Up To 10 Tons - - - - - - - - - - - - - - 54
New Burglar Alarm Uses Radio - - - - - 55
Metal "Ears" Locate Sounds In Fog Or Darkness - - - - - - - - - - - - - 57
Conveyor Speeds Shoeshine - - - - - - 57
Portable Aviation "Lighthouse" Uses Dry Batteries - - - - - - - - - - - - - 63
Midget Skis Set On Rollers - - - - - - 63
New Tool Cuts Hot Rolled Steel At High Speed - - - - - - - - - - - - - - 69
Wings Serve As Radiators - - - - - - - 72

[*Continued on page 12*]

1935
1936
1937
1938

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INVENTORS

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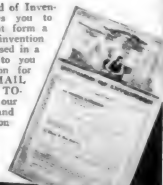

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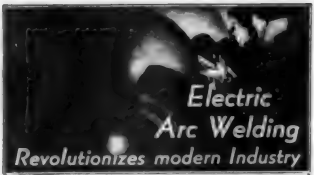
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CONTENTS—Continued from page 8

FOR THE WORKSHOP FAN

Model Airplane Novelties - - - - - - - [illegible]
Adjustment Adds Flexibility To Bench Vise [illegible]
Luminous Paint Easily Made - - - - - [illegible]
Novel Kinks For Garage And Auto - - - [illegible]
Washing Machine Motor Powers Bicycle - - [illegible]
Bolt Serves As Emergency Tap - - - - [illegible]
Build This Bath Yacht For Baby - - - - 107
Non-Slip Wall Pictures - - - - - - - - 107

PHOTOGRAPHY

A Range Finder For Automatic Camera Focusing - - - - - - - - - - - - - 108
Make Your Own Photographic Name Cards 111
Aids For Amateur Photographers - - - - 112
12 Pictures On 3-A Film - - - - - - - - 113
Improve Your Pictures With These Tested Photo Kinks - - - - - - - - - - - 114
Amateur Photo Puzzlers - - - - - - - 118

DEPARTMENTS

Random Chips From The Editor's Workbench 14
Solving The Readers' Problems - - - - 23
Nic Sprank's Science Oddities - - - - - 34
Workshop Hobbies - - - - - - - - - 73
Handikinks For Outdoor Campers - - - - 88
Radio Sparks - - - - - - - - - - - 89
Tips For Modern Motorists - - - - - - 96
New And Timely Handikinks - - - - - 106
Amateur Photo Puzzlers - - - - - - - 118

MISCELLANEOUS

Yale Group Studies Rockets - - - - - - 41
1927 Car Goes Streamline - - - - - - - 50
Bank Gives Drive-In Service - - - - - - 50
Railroads Run Special Cars For Amateur Photographers - - - - - - - - - - 51
Makes Old Rifles As Hobby - - - - - - 51
All-Wood Kayak Seats Three - - - - - - 51
Synthetic Horsehair Created - - - - - - 54
Plastic Produces Quartz Effect - - - - - 54
Plant Operates Under Water - - - - - - 55
Settee Resembles Old Wagon - - - - - - 57
Sketch Pad Eases Work - - - - - - - - 63
Gigantic Steel Pipe Line Extends 10 Miles - 69
Model Stratosphere Airship Is Propelled By Air Currents - - - - - - - - - - - 72
Radio Hooked On Cultivator - - - - - - 72

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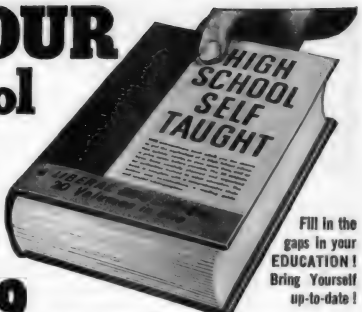

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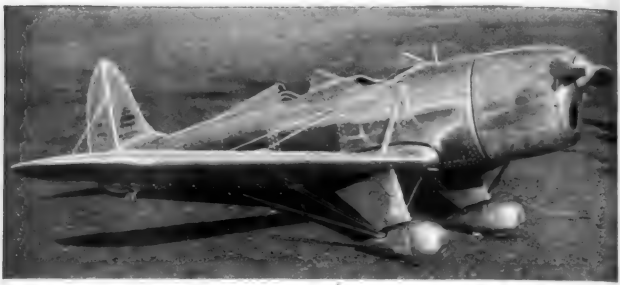


Built by Kenneth Lee and Jack Weyer, aeronautical students, this gasoline-powered scale model of a Ryan ST airplane required 1,200 hours to construct. The duraluminum "skin" is fastened to fuselage frame with 1/8 aluminum rivets. Length is 4 feet.

THE flying of gasoline-powered models is fast becoming one of the leading outdoor hobbies. Involving, as it does, the elements of craftsmanship plus the thrill of watching a model make a sustained flight of ten, twenty, or even sixty minutes, the construction of an airplane model powered by a miniature gasoline motor affords a double measure of satisfaction. Get on the "band wagon," readers, and participate in this thrilling hobby.

***

A photo and a letter concerning one of the best looking "gas" models we have ever seen won the first prize of $5 in this month's Workbench contest. Kenneth Lee and Jack Weyer, co-builders of the model, sent in the letter, which reads:

Dear Editor:

While students at the Ryan School of Aeronautics here, we built a 4-foot "gas" model of the famous Ryan ST training and sport plane. Completed, as shown in the accompanying photo, the model represents over 1,200 hours of work.

Bulkheads, wheel pants, cowling, etc., are made of metal hand-worked with dies and forms. The "skin" is .016-24 ST duraluminum and features 1/8 aluminum rivets. Wings and tail surfaces are made of balsa ribs covered with Japanese silk and doped to provide an aluminum finish.

The model, powered by a miniature gasoline motor of one-fifth horsepower, was judged the best looking model entered at a meet that attracted 89 entries. The model is 4 feet long, has a wing span of 5½ feet, and weighs 6½ pounds.

Kenneth Lee.
Jack Weyer.

We certainly agree with the decision of the model contest judges and believe MM readers will too. The Ryan ST is a winner in every sense of the word.

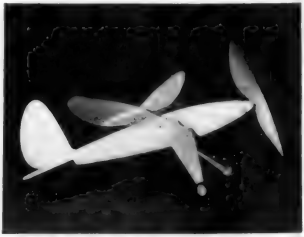
***

Another letter and photo relating to model airplanes, but to a rubber-powered type, was received from Paul Gustafson, of Columbus, Ohio, who was awarded a prize of $3. He writes:

Dear Editor:

I am enclosing a photo of my latest rubber-powered airplane model. As you can tell from its streamlined shape, it is designed for speed.

With the exception of fittings, balsa wood was used



Featuring a balsa covered fuselage and a solid balsa wing and tail surfaces, this streamlined rubber-powered model maintained flight for one minute, according to builder Paul Gustafson.

the Editor's Workbench

throughout. Span is 13 inches, length 10¼ inches, and propeller diameter is 6 inches. Two 15-inch loops of ⅛ brown rubber comprise the motor.

Paul Gustafson.

Gustafson's balsa model should interest all modelers who appreciate excellent craftsmanship in constructional details combined with beauty in appearance.

***

This season has brought forth many types of soapbox racers. Richard G. Kirkton, of Canon City, Colo., sent in a photo and letter relating to his racer which was awarded a $3 prize. He says:

Dear Editor:

My cousin and I constructed a soapbox racer (photo enclosed) from ideas we got from your description in a last year's issue of MM. We used bike spindles on the front axle and a split axle at the rear.

The wheels of the racer are 11-inch coaster wagon wheels equipped with roller bearings. The finish features rich maroon and yellow paint.

Richard G. Kirkton.

Soapbox racing provides many thrills. If you have a fair-sized hill nearby, follow Kirkton's example and construct one of these snappy little racers.

***

Another letter and a project photo that won an award of $3 were received from Ellis Butler, of Bowie, Texas, who states:

Dear Editor:

I am enclosing a snapshot of one of the four boats I have built from plans in the MM book, "How to Build 20 Boats." As you can see, it is a "Little Bear" type.

Your plans are sure easy to follow and I am hoping you will soon bring out a new boat book.

Ellis Butler.

This trim "Little Bear" sailboat is only one of four types that were built by Ellis Butler, of Bowie, Texas, from plans in the popular MM book "How To Build 20 Boats." It sails well.

When a reader builds four boats from plans featured in a single book it speaks well for the book. Reader Butler, like thousands of other boat fans, will be happy to know that MM's latest "How To Build 20 Boats" book is now available. The price is only 50c per copy at your local newsstand, or from MM at Greenwich, Conn.

***

Turning to midget autos, we have an interesting letter and a photo from Jack Campbell, of Denver, Colo., which won an award of $3. His letter reads:

Dear Editor:

Enclosed is a photo of my Midget Miller midget auto which was built from plans that appeared in MM some time ago. I used a one horsepower motor instead of the ¼-horsepower engine you specified so I had to change the clutch. Outside of that, I followed your plans in all details.

[Continued on page 16]

Ready to provide fast rides down nearby hills, this soapbox racer features coaster wagon wheels equipped with roller bearings. Richard Kirkton, of Canon City, Colo., built it.

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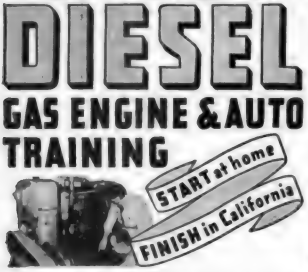

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Editor's Workbench Chips

[*Continued from page 15*]

Powered by a motor developing only one horsepower and using a combination belt and chain drive, Jack Campbell's Midget Miller auto travels at 20 m. p. h. MM plans were used.

The car travels about 20 m. p. h., using a combination belt and chain drive. I will be glad to answer any letters from MM readers.

Jack Campbell.

Readers who desire to obtain some first-hand information on midget autos should take advantage of Campbell's offer to correspond. Be sure and enclose a stamped, addressed return envelope with your inquiry to him.

***

Pleasing to the editor is the letter received from R. G. Penney, of Feilding, New Zealand. He writes:

Dear Editor:

I have derived lots of benefit from the articles in MM. The trailer "Cruisemite" is going to be my project during the coming winter (your summer) if all goes well.

I made the chemical battery which was explained in one of the articles you published and am very much pleased with it. Installed in my bedroom, it operates a torch bulb over the light switch when the door is opened.

I might add that I will be glad to give your readers any information I can with regard to letters concerning New Zealand. My address is P. O. Box 18, Feilding, New Zealand.

***

R. G. Penney.

Penney's offer to correspond should appeal to those readers who like to establish "Pen-Pal" contacts with fellow hobbyists in foreign lands.

***

An interesting boat project letter and photo which were awarded a $3 prize was sent in by

[*Continued on page 18*]

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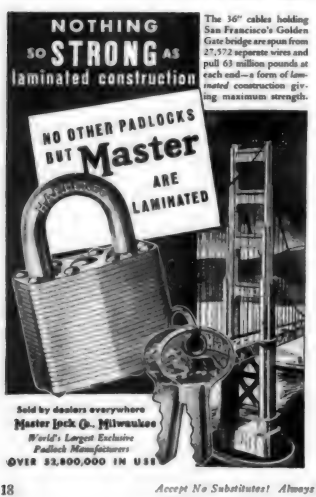
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Editor's Workbench Chips

[*Continued from page 16*]

At a cost of only $30 including sail and rigging, Bob Cordner, of Montreal, Canada, built this side-keeled sailboat. It was built from MM boat book plans that appeared in 1933.

Bob Cordner, of Montreal, Canada, who states:

> Dear Editor:
>
> I am sending you a photograph of my "Privateer" which was built from MM plans for "Tubby" published in the 1933 edition of your boat book.
>
> I built the craft last summer at a total cost of $30, including sail and rigging. As you can see from the photo, she has proved to be a seaworthy sailer. I hope you will continue to print many more simple and successful designs for small sailboats.
>
> Bob Cordner.

We admire Cordner's craftsmanship as we do his choice of an appealing name for the MM designed boat.

***

Readers of the Workbench are reminded to send in letters and photos describing their own completed projects. Each month, a first prize of $5 and additional prizes of $3 each are awarded for the letters and photos which, in the opinion of the editors, appear to be the most interesting received. Send your letters and photos NOW.

NOTICE

Due to the need for larger office space, the editorial staff of MM has moved to the Paramount Building in N. Y. City. However, all orders for blueprints and MM publications should be sent to our Greenwich, Conn., office.

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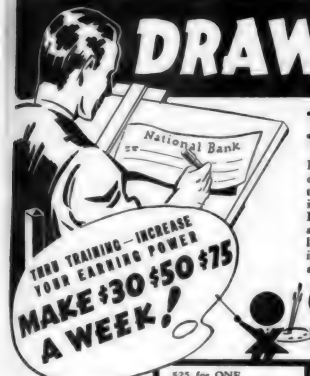

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Dr. Wm. R. Kent of 27 St. Paul Ave., Newark, N. J., won enough in Art prizes to pay for his course.

THANKS WSA FOR JOB

J. J. Beaird of Columbus, Georgia, credits WSA training for his job as Art director.

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Many of our most successful graduates never studied art before enrolling for the W.S.A. course. It's never too early or too late to start learning to be an Artist. You start by drawing a straight line and then, as you acquire the ability, you advance step by step, mastering one subject at a time with two years to complete the course. All the constructive help you need is given.

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Working Model Helps Sales

TO ASSIST salesmen in explaining the features of a new road-building machine and thus help to make sales, a Detroit manufacturer constructed a miniature working model of the machine. Hydraulically operated, the five-foot model of a road scraper can perform every maneuver capable of being undertaken by its twenty-foot prototype.

X-ray Sees "Around" Bones

A NEW X-ray machine which, in effect, sees "around" bones to take accurate cross-sections of body tissues has been invented by John Kieffer, superintendent of the mechanical laboratories at the Connecticut State Tuberculosis Hospital at Norwich, Conn. He conceived the apparatus while ill with tuberculosis that attacked his breastbone and physicians had told him they could not make a proper diagnosis because they could not photograph the bone.

In operation, the new X-ray tube is mounted over a table at the top end of a vertical shaft. An X-ray film holder is attached under the table to the lower end of the shaft. A motor drive on the vertical shaft is used to move the tube and film in opposite directions. The depth at which a cross-section view of body tissues is to be taken is determined by a simple adjustment of the height of the tube and its motion.

Physicians are said to hail the new device as the greatest single step ahead in the diagnosis of disease since discovery of X-rays more than forty years ago. Formerly, X-ray pictures showed only a mass shadow of the organs of the body or of an entire arm or leg, with many parts partially or wholly obscured. The new invention eliminates this trouble.

NEW DELTA TOOLS *will be out soon*

New 1938 Line to Be Announced Shortly

Many important improvements and new tools of interest to all will be found in the 1938 Delta Line

The New Delta 10-inch Circular Saw, shown in the illustration above in combination with the new Delta 6-inch Jointer, is the largest, heaviest and most completely equipped circular saw yet offered for the home work shop, tool shop, pattern shop, contractor and builder. It has numerous exclusive features that make it the season's outstanding tool.

Year after year Delta engineers continue their work of improving existing models and developing new models of quality, low-cost, motor-driven tools. The coming 1938 season is no exception. Important announcements of new Delta Tools will be released shortly, announcements that will be of tremendous interest to all those who are contemplating additions to their shop. Before selecting new tools—be sure to see the 1938 Delta Line.

SEND COUPON TODAY!

So Your Name Will Be on Our Mailing List

The new 1938 Delta Catalog will be off the press soon. It will contain full description, illustrations and photographs of the complete Delta Line, including the many new Delta Tools with improvements incorporated in the 1938 line.

Every man interested in low-cost, quality tools should see the new Delta Catalog. In order to make sure that your name will be placed on the mailing list to receive a copy, send the coupon below today. At the same time enclose only 10c for the new 1938 book of "Practical Delta Projects," Book No. 4 containing 32 pages of new and novel things to make, with many blue prints, working drawings, photographs, illustrations—and complete directions. Be sure to mail the coupon at once.

New 1938 Project Book

Now out, the new 32-page book No. 4 of "Practical Delta Projects"—crowded with new and "out of the ordinary" things to make—with many photographs, working drawings, and easy-to-understand illustrations. Simple, complete instructions make every project easy to follow. Every woodworker should have this book. Send 10c with coupon. 1938 Delta catalog mailed postpaid.

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—till he gained 14 POUNDS QUICK this easy way

New IRONIZED YEAST tablets give thousands 10 to 25 lbs.

THOUSANDS of skinny, rundown people who never could put on an ounce before have recently gained 10 to 25 pounds of solid, naturally attractive flesh, new pep and popularity—*as fast as five weeks!*

They're taken this new, scientific formula, Ironized Yeast, which although developed at the cost of thousands of dollars comes in pleasant tablets which cost you only a few cents a day!

Scientists have discovered that many are thin and rundown simply because they do not get enough yeast vitamins (Vitamin B) and iron in their daily food. One of the richest sources of marvelous health-building Vitamin B is the special yeast used in making English ale, world-renowned for its medicinal properties.

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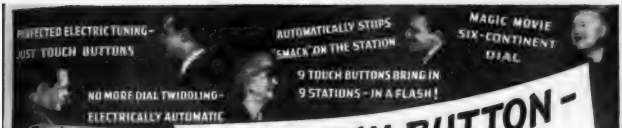
WARNING: Beware of the many cheap substitutes. Be sure you get the genuine Ironized Yeast.

Improved Sonic Altimeter Developed By Physicist

The acoustic altimeter, an instrument long and sorely needed by aircraft, is about ready to leave the physics research laboratory and go into the hands of manufacturers' designing engineers. Such is the opinion of Lieut. Leo P. Delsasso, U. S. Naval Reserve. Lieut. Delsasso, who is physicist at the University of California in Los Angeles, has been a pioneer in the development of devices for marine depth-sounding, and for measuring the height of aircraft from the earth.

Altimeters, or height gauges, as now used by airplanes are of barometric type, and show more or less accurately elevation above sea level. Unfortunately the distance down to sea level is of slight importance to a pilot flying through fog over land of unknown altitude. The altimeter of acoustic type as developed by Lieut. Delsasso depends upon the time taken by sound to travel from a plane to earth and back. Early models tried out in both the Los Angeles and eastern laboratories required such nuisances as earphones, great concentration to signals by the pilot, timing and bothersome computations.

The improved model now being tested has an automatic mechanism which translates the complex echo phenomena into a simple movable point of illumination on a dial. Altitude is thus directly and constantly shown. Even the angle of terrain can be determined by a simple measurement of change of pitch during the round trip of the sound. For low levels, Lieut. Delsasso points out, the instrument is extremely accurate.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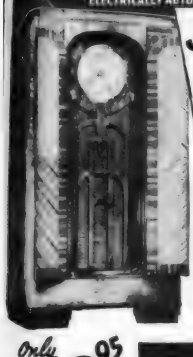

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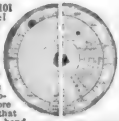

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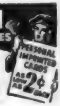

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REGISTRATION OF MOTORBOATS

I have just purchased a 16-foot boat to which I am attaching an outboard engine. Can you tell me if it is necessary to register the boat and where I can apply for such registration if necessary?—Carl Jacoby, Brooklyn, N. Y.

The Collector of Customs, Custom House, Bowling Green, New York City, has charge of registration of all power boats in the New York District, and should be consulted on all matters of Federal navigation law applicable to pleasure boats.

LICENSING OF GLIDERS AND SAILPLANES

My club has just completed the construction of a primary glider and we would like to know if it is necessary to license the craft before making a test flight with it? Does N. Y. state require a special license for gliders?—Herbert Meyers, Mineola, L. I.

Your glider must have a Federal license before it can be used. N. Y. state requires gliders to comply with the Federal laws but does not require a special license. Full information on glider license requirements can be obtained from the Bureau of Air Commerce at Washington, D. C.

MICROFILM COVERING FOR MODELS

I have seen photos of airplane models which had a transparent wing covering that is said to be eight times lighter than tissue paper. Can you tell me where I can obtain the material used to make this type of wing?—David Hanser, Greenwich, Conn.

Undoubtedly, you are referring to microfilm. Cans of microfilm liquid for making this wing covering can be secured at any model shop. Full instructions for making this covering would take too much space to be published in this department, but your model dealer will be glad to inform you as to the proper procedure necessary.

PROTECTING OUTBOARD MOTORS

I use my outboard engine in salt water and have been troubled with corrosion. Is there anything I can do to stop this, as I have purchased new parts and do not want to have the same trouble again if it can be avoided.—John Thomson, N. Y. C.

Immediately after using your motor in salt water wipe off the salt spray and wash the motor off with fresh water. If you have an old rain barrel it would be a good idea to fill it with water, clamp the motor to the inside of the barrel and run it for a few minutes. This will circulate the fresh water through the motor pipes and help to destroy the corrosive action of the salt water that passed through. Wipe off the outside parts of the motor with an oily rag.

WATERPROOFING LEATHER ARTICLES

Having been unable to secure any information on the waterproofing of leather articles, I am writing MM to see if you can provide me with such data?—Arthur Lister, New City, N. Y.

The quickest process we know of for waterproofing leather is as follows: the leather is first treated with a solution of 62 parts of soap, 124 parts of glue, and 2,000 parts of water. When it has become saturated with this solution, it is treated to rubbing with a mixture of 460 parts of common salt and 400 parts of alum in sufficient water to dissolve these substances. The leather should then be washed with tepid water and dried. The application of the soap requires about two hours and the subsequent treatment about the same.

PROCESS FOR REMOVING PAINT EASILY

Can you supply me with any information as to how paint can be removed quickly and easily? The paint is on a wood base.—George Hart, Auckland, New Zealand.

Apply a mixture of one part oil of turpentine and two parts of ammonia. This is very effective. The two liquids must be shaken in a bottle until they mix like milk after which it is applied to the coating with a little oakum. After a few minutes the old paint can be wiped off with ease.

MAKING A PRESERVATIVE FOR FLOWERS

I am interested in collecting specimens of various flowers and would appreciate any data concerning a method by which they can be preserved.—James Burke, Toronto, Ont., Canada.

To preserve flowers they should be dipped in melted paraffine, which should be just hot enough to maintain its

[*Continued on page* 30]

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Problems

[Continued from page 28]

fluidity. The flowers should be dipped one at a time, held by the stalks and moved about for an instant to eliminate air bubbles. Fresh cut flowers, free from moisture, are said to make excellent specimens when treated this way.

LUBRICATION FOR FIREARMS

Do you know of any lubricant for firearms that can be made up cheaply, but which is just as effective as some of the commercial preparations?—John Love, Chicago, Ill.

Commercial firearm lubricants are generally preferred because they are supplied in a compact container. However, you can make a satisfactory lubricant by using pure vaseline oil, white, or pure white-bone oil. Both of these oils are free from acid and do not oxidize or resinify.

DESTROYING FUEL OIL ODOR

By accident a quantity of fuel oil leaked out of a tank and covered the floor of our cellar. We cleaned up the oil, but have been unable to remove the strong fuel oil odor. Can you suggest some method of doing this?—Fred Allerton, Detroit, Mich.

Sprinkle some vinegar upon your cellar floor and open the cellar windows and door. If this is done for several days, the fuel oil odor will disappear. To thoroughly remove every trace of the spilled oil, it is advisable to sprinkle powdered asbestos over the cellar floor before using the vinegar. This will insure a clean job.

MEANING OF COMPRESSION RATIO

While reading back issues of MM I came across the term "compression ratio" in several articles dealing with automotive and marine engines. Please tell me what the meaning of this term is.—Edgar Johnston, Sydney, Australia.

Compression ratio is defined as the volume of gas in a cylinder when the inlet valve has just been closed, divided by the volume of gas in the cylinder after the compression stroke has been completed. For example: if a cylinder contains one cubic foot of gas just after the inlet valve has closed and it is compressed into a space of one-quarter cubic foot after the compression stroke has been completed, the compression ratio would be one cubic foot divided by one-quarter cubic foot, or a compression ratio of four to one.

LICENSING GAS MODEL AIRPLANES

Can you tell me if it is necessary to obtain a license for model airplanes that are powered by miniature gasoline engines? A local policeman expressed his opinion that some state law covered such models.—Jack Smith, Yonkers, New York.

To the best of our knowledge there are no laws governing the flying of gas powered models in any state. However, changes are made on short notice so in order to be sure we advise that you address an inquiry to the New York State Police Headquarters at Albany, N. Y. Several aero clubs issue identification numbers for the gas models flown by their members.

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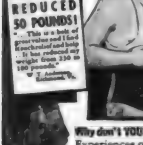

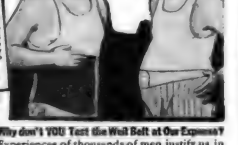

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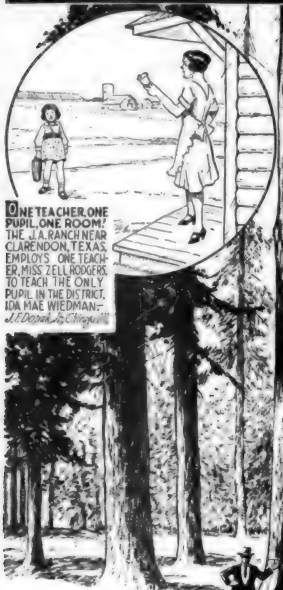
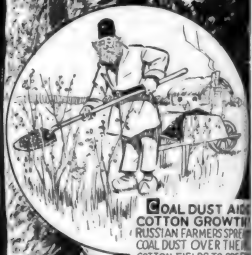
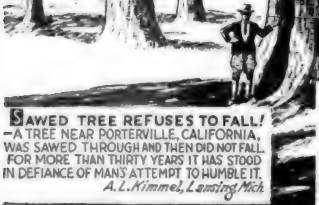


ONE TEACHER, ONE PUPIL, ONE ROOM!—THE J. A. RANCH NEAR CLARENDON, TEXAS, EMPLOYS ONE TEACHER, MISS ZELL ROGERS, TO TEACH THE ONLY PUPIL IN THE DISTRICT, IDA MAE WIEDMAN.—*J. E. Dorsch, Jr., Chicago, Ill.*



COAL DUST AIDS COTTON GROWTH!—RUSSIAN FARMERS SPREAD COAL DUST OVER THE SNOW ON COTTON FIELDS TO SPEED UP CROP RIPENING. THE DARK SURFACE ABSORBS HEAT FROM THE SUN DURING THE DAY AND RADIATES IT DURING THE NIGHT.—*John Salmon, Coalridge, Ala.*



SAWED TREE REFUSES TO FALL!—A TREE NEAR PORTERVILLE, CALIFORNIA, WAS SAWED THROUGH AND THEN DID NOT FALL. FOR MORE THAN THIRTY YEARS IT HAS STOOD IN DEFIANCE OF MAN'S ATTEMPT TO HUMBLE IT.—*A. L. Kimmel, Lansing, Mich.*

TOWN UNDER WATER!—THE TOWN OF DON PEDRO BAR, CALIF., IN WHICH WERE CAST 1,500 VOTES DURING THE 1865 PRESIDENTIAL ELECTION, NOW LIES UNDER 160 FEET OF WATER. IN 1923, WATER BACKED UP BY THE DON PEDRO DAM COMPLETELY INUNDATED FOREVER, THIS ONCE FAMED MINING CENTER.—*James Kole, Bell Tower, Calif.*

Nic Sprank

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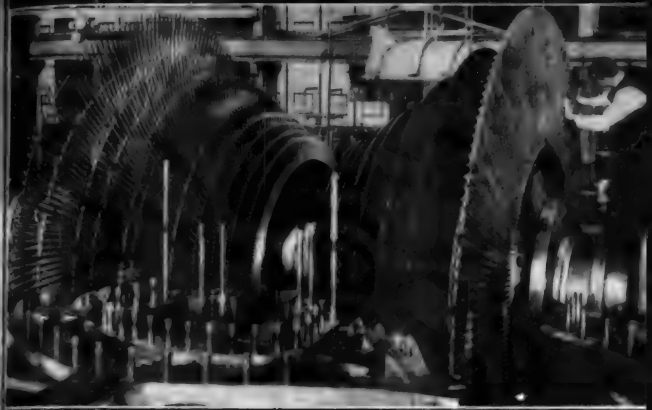
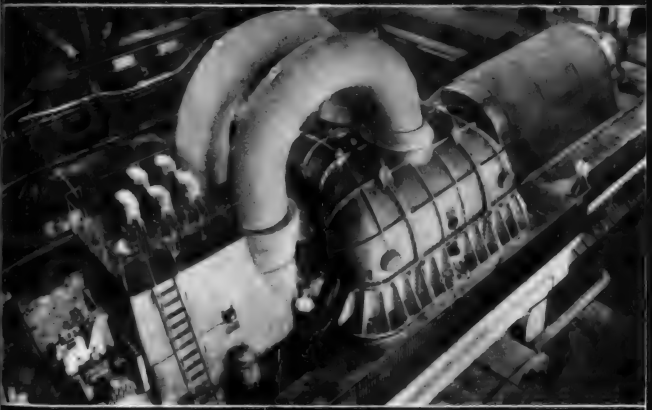
The fan-like internal structure of a huge steam turbine designed for driving an electric generator. High pressure steam enters through a close-fitting cover at the center and spreads through the "windmill" in both directions, transmitting its energy to the drive-shaft. There are 1,500 blades. The largest measure thirty-eight inches and move with a tip speed of thirteen miles or approximately a foot as a rifle bullet. Turbine turbines such as these have made modern large scale power generation possible.



Windmills for Steam

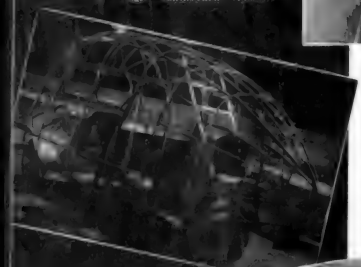


The world's largest single-shaft turbo-generator has been installed in the Richmond Station of the Philadelphia Electric Company. Made by the Westinghouse Electric and Manufacturing Company, it produces 165,000 kilowatts, about enough to light continuously 7,000,000 twenty-five watt lamps, or one in every fourth home in the United States. The turbine runs at such

THE TRAILMOBILE

Automotive prophets forecast a new type of home-on-wheels for the modern outdoor enthusiast.

The new Pribil Safety Car features all-steel monocoque construction below.



The roomy interior of the Pribil car (above) could easily be converted into a home-on-wheels such as pictured on cover of this issue of MM.

WHAT is the house trailer doing to the automobile? How is the automobile to look after it has been revamped by this new and increasingly popular vehicle of personal transportation? Will the motor car combine with the trailer to create a "touring and living car"—a car that we might call the "Trailmobile" or some other appropriate name?

The "Trailmobile" of the future may readily evolve from the novel Pribil car shown here.

Revolutionary Self-driven TRAILER HOME

by Frederick C. Russell

These are questions that are spurring the automotive prophets on to new heights. Many highly visionary ideas are being advanced; but even the most casual observer cannot help but note that the automobile is well on its way toward being made over to fit the new trend in personal travel. Many engineers believe it is not improbable that within a few years the car and its trailer will become a single unit, the new craft embodying all the comforts and advantages of each vehicle without some of the present disadvantages.

In this process of the tail wagging the dog we cannot help but be impressed by the astounding lack of comforts and conveniences in the automobile itself. You can't even get a drink of water from a car, even though there may be five gallons of it circulating around the engine. This water is so restricted in its process of cooling the engine that there isn't any convenient point where you can use it to boil an egg. The reverse of all this is the marvelously compact and convenient house trailer which helps to focus attention on the lack of even the bare necessities of long distance travel in the car itself.

On the horizon there are some broad hints of the new vehicle which should emerge from the present situation. One is the increasing interest in larger generators for the automobile. It has been possible for some time to have installed a 110-volt generator which can be brought into action by engagement with the fan belt. While the engine is running, and at a cost of the small amount of fuel consumed in idling, it is possible to generate enough current to light a tent. This current is also sufficient to operate several electrical devices of the home type, thus paving the way to greater convenience for the tourist.

With all of its sedan models one of the popular makes of cars is offered with special cushions which become the mattress for a full-length bed in the tonneau. When swung up the rear seat provides a clothing shelf similar to that found in Pullman cars. Pas-

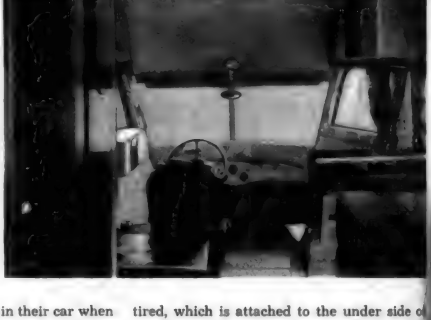
MODERN MECHANIX Believes That—the only answer to growing anti-trailer legislation is a better, more sensible home-on-wheels. Some pioneers have already experimented with the "Trailmobile" idea pictured on the front cover; we think that the construction of such a real "touring car" could readily be undertaken by any home craftsman. A single unit trailer—home of this kind appears to be much more practical than the unwieldy combination of an ordinary automobile and a big van hanging on behind. Eliminated will be such pressing problems as double brakes, extra axles and tires, unreliable hitches, poor acceleration, zero rear visibility, difficult steering and parking.

Would you, as a present or prospective "trailer" user like to see plans for building an actual "Trailmobile?" Will you help us design the trailer-home of tomorrow by sending in ideas that you think should be incorporated in it? Get busy with pencil and paper, and let's make a vehicle that will be welcomed in any community instead of being chased away!

Editor, MODERN MECHANIX,
1501 Broadway, New York, N. Y.:
I'd like to see complete plans for building the Trailmobile (Note: If you have ideas on fixing up the Trailmobile, write a separate letter. Thank you!)
Name .....

FLASH!

Just as this issue of MM went to press, we received photos and a description of a newly developed mobile home that incorporates many of the features of the "Trailmobile" envisioned in this article. Developed by the Dodge Division of the Chrysler Corporation, the auto-home (above) is the latest auto world innovation. Special body was made by Indian Trails, Inc., Owosso, Mich.



The driver sits on a single seat in the new Dodge mobile home (right), but additional seating space is provided by the seat at right of driver and by a wall seat at the left and rear of him. Note the window shades. Mounted on a 1½-ton truck chassis, the auto-home body features wardrobes, a kitchen with a portable stove and ice box, and two seats that convert into beds at night. Although the use of conventional trailers has increased during the past few years, many automobile authorities forecast a greater use of "trailmobiles."

sengers can lock themselves in their car when sleeping, or if they prefer extra ventilation for summer camping, they can lift up the cover of the luggage compartment in addition to opening the windows.

Cooking by automobile has frequently been done via the pressure system, a special cooker being attached to the exhaust pipe. While passengers tour their dinner is being prepared for them. Such an accessory has at least served to prove what can be done with the great surplus of heat that is wasted along the exhaust line. The hot air "stove" for the carburetor and intake manifold has served for many years to improve the carburetor mixture, but why not include a stove on which a tourist can cook a simple meal?

Much is expected from the more complete electrification of the automobile. It is not uncommon now for commercial trailers to be equipped with a fifth wheel, pneumatically tired, which is attached to the under side of the chassis. Its purpose is to supply the extra current needed to operate amplifiers and phonographs. It is but a short step from this to a fifth wheel which can be dropped to the road from the touring car when extra current is needed. This current will be stored for further use when the car is parked for the night. One such auxiliary generator has an output of 20 amperes at 20 miles per hour.

The biggest obstacle in the path of further development of the automobile is the reluctance of designers to meet the increasing demand for a more useful motor car, one that can offer the advantages of the trailer and the automobile in one complete unit. Nothing is considered impossible in the design of trailers, whether it be air conditioning, refrigeration, heating or advanced sanitation. In the designing of cars engineers thought they had made amazing advances when they

added a small fan to the generator to keep it cool while turning out a little more current to keep the battery up to par when lights, radio, heater and other electrical devices were being operated simultaneously. This was considered an achievement, little consideration being given to the fact that for years engineers have effectively cooled a much more difficult unit—the engine itself.

Fans, defrosters, heaters and other incidental equipment of the modern car are considered as marked advances in comfort, but by comparison with the improvements in the mechanical design of cars, developed as an essential to performance and efficiency, they are almost in the toy class. As the motoring public becomes accustomed to the real comforts of the house trailer they will be aware of the present lack of even the barest necessities in equipment in the car itself. The logical step will be for the motorist to demand such comforts in his car.

Such improvements can be had. It is just a matter of the motor tourist stopping to ask himself, "Why not combine the trailer with the automobile?" That might provide a means of escaping many restrictions which are being placed on trailer use by the various states. It should cut operating costs as well as the initial cost. Three hundred dollars added to the price of the average car, in return for the conveniences needed to make it more liveable, would be cheaper than attaching a trailer, and much more convenient.

There have been some experiments along these lines. Most of these, however, have been for publicity purposes. Nevertheless they suggest what can be done to make the automobile itself the public's real outdoor home. As it is at present, many motorists must stop off every 200 miles or so for gasoline. They have no extra supply of oil, no means of obtaining even a little extra water for the cooling system if something goes wrong. Dirigibles extract water from the exhausts of their engines. A transatlantic liner makes its complete crossing—in fact, has to—without refueling. If the automobile tourist cannot find a corner filling station he is lost.

Not until the modern car is more self-contained will it be useful for the more extensive touring on the byways which the trailer era invites. Nor will the trailer itself be completely satisfying as a means of "getting away

A step in the evolution of the "Trailmobile" is evident in some of the modern autos which feature a rear seat that swings up (left) to provide clothing shelf and bed in true Pullman style. Below—View from luggage compartment.

from it all" until the automobile is designed to stray further from the beaten track without causing its owner constant worry. When these changes are made, naturally engineering ingenuity will go the limit. The real American touring car will be the result.

This all-in-one vehicle will carry permanent jacks so that to raise the car for a tire change or brake adjustment it will be necessary merely to touch a button on the instrument panel. Permanent jacks, mechanically operated, have from time to time appeared on the accessory counter. They failed to make headway because the motorist felt he did not need them. "I'll just call up the service station," he assured himself. But now that he strays far away in the trailer he knows how important the jack has become. He will want jacks "all around" on his touring car of the future, and—he'll get them.

Not until the trailer came into the picture did the motorist realize to what extent he could "live" on the road. Naturally he did not notice until this time just how much he had lacked in his automobile. There was a hint of housekeeping on wheels when the closed car first made its bow, if you recall the cut glass flower vase which was considered essential to the well-appointed sedan. Today things have reached a point where anyone who goes touring in the high, wide and handsome manner of the hour expects to be able to have all the conveniences from cracked ice for a Tom Collins to hot water for a shower.

Heating is unnecessarily deficient in the average automobile. It is dependent largely on a cooling system which normally operates at too low a temperature. This, in turn, is due to use of oversize cooling systems to compensate for the average owner's negligence to have things kept in good working order.

[*Continued on page 122*]

"Atom-Smasher" Creates 100-Million-Mile Speeds

INDUSTRIAL engineers of the Westinghouse company, expecting to solve some of the mysteries surrounding the structure of matter, are preparing to bombard targets of various material with submicroscopic particles shot from a giant "atom-smasher" at 30-million to 100-million miles an hour.

Now being constructed at the company's research headquarters in East Pittsburgh, is the world's largest unit for conducting experiments in the field of nuclear physics. It consists of a huge pear shaped tank, thirty feet in diameter and forty-seven feet high, housing an electrostatic direct current generator and other required parts including a forty-foot vacuum tube through which particles are shot in the bombarding of various types of targets. The structure, including a two-story building underneath, will be sixty-five feet high.

Voltages generated in the "atom-smasher" will range to 5,000,000 and beyond, accelerating particles through the vacuum tube.

Artist's conception, made from engineering drawings, of the "atom smasher" now under construction. The pear-shaped tank will be 30' in diameter, 47' high, and weigh 90 tons.

New Garbage Can Foils Dogs

New garbage can mounting which is said to make these receptacles dog-theft-proof. The cover handle is fastened to the framework by means of a hinged rivet lock joint which eliminates removal of top.

EVEN the garbage can must yield to change. One practical minded inventor has devised a metal stand for cans which is claimed to make these receptacles dog-theft-proof. The can itself is elevated above the ground and is encircled with strip metal so that it will not upset. A lock joint holds the cover closed.

Yale Group Studies Rockets

ROCKETRY, long considered far off the main path of the engineering sciences, is attracting the attention of student engineers at Yale. The Yale Rocketry Club, consisting of engineering students and devoted to the study of fundamental rocket principles, plans to carry out actual experimentation and research in this field.

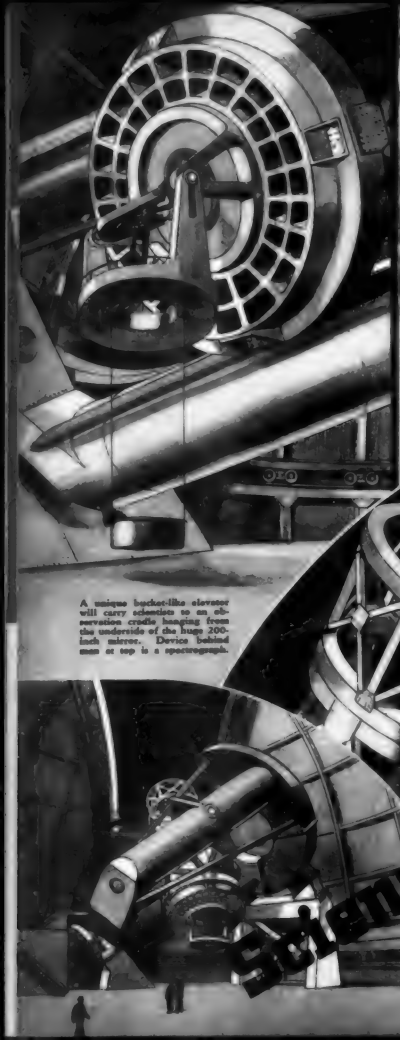
Experimentation in rocketry has passed the phase of sending up rockets for the purpose of gathering pertinent facts about the efficiency of the device. Proving stands, built to hold the rocket motor securely to the ground, having delicate gauging mechanisms, furnish data on fuel flow, fuel tank and combustion chamber pressures, and jet reactions. This is the method the Yale Rocket Club plans to use. The most pressing problems for rocket research are those concerning liquid fuels of satisfactory efficiency.

The starting point— sky, noted designer o liners, studies a scale bodying his S-43 sea sign. The hull lines features of a new de easily visualized with than on drawings. The is to conduct wind tu

From MODE

In a vertical wind tunnel (above), a larger model is tested for its aerodynamic qualities. Right—Production started. Metal aircraft construction enables the builder to stamp out large and small parts on huge mechanical and hydraulic presses, serving to speed up and standardize production.

The metal skeletons of the control surfaces are assembled (left) and then covered with fabric. The holes in the stamped ribs serve to reduce weight. Center—The hull is formed in a jig. Bulkheads and frames are properly located and the metal covering riveted in place. Top—The final assembly, with three Sikorskys nearing completion. After the engines are "run in", the planes receive severe flight tests.



Like a giant cannon aimed to "shoot" the stars: how the completed telescope will appear from the central position when it is pointed farthest north.

A unique bucket-like elevator will carry scientists to an observation cradle hanging from the underside of the huge 200-inch mirror. Device behind man at top is a spectrograph.

Science Builds

Above—How observers will g in and out of the darkroom ca in the nose of the telescop where they will photograph cele stial objects. Left: Made t approximate scale, this drawin gives some idea of the staggerin proportions of the "Cyclops e Mount Palomar."

Greatest Telescope

by John Edwin Hogg

NINE years ago Palomar Mountain was a little-known mass of rock and earth in San Diego county, California. Being only 6,129 feet high, it is a mere foothill without even the distinction of altitude in a state where [illegible] perpetually snow-clad peaks rise to perpendicular heights of nearly three miles. A few Californians knew [illegible] a good place to go deer hunting. Others, well-versed [illegible] lore, had heard of it as the home of Nigger Nate [illegible] slave who for many years lived the life of a re[illegible] up on Palomar's forested slopes. Then suddenly, [illegible] October 28th, 1928, Palomar Mountain blared from the [illegible] of every important newspaper in the world. It [illegible] about to become a modern Olympus—the scene of [illegible] greatest single scientific endeavor ever undertaken [illegible] man. After years of painstaking study and research [illegible] astronomers in every part of the world, the board of [illegible] of the Rockefeller Foundation had set aside a [illegible] viciously estimated at from six to ten million [illegible] to crown Palomar with an astronomical [illegible] housing a telescope beyond all [illegible] dreams—an instrument twice the [illegible] of the present world's largest, the [illegible] 100-inch Hooker telescope [illegible] the summit of Mount Wil[illegible] The machinery was [illegible] in motion to push [illegible] the mysteries.

Monster 200-inch "eye" will reveal hitherto unknown secrets of the universe and enrich man's knowledge of life on earth.

Below: Plastic scale model of the California telescope made to test the utility of the design and [illegible] strain investigations with polarized light to show points of [illegible] or undesirable strain. Note figure of man at base for size comparison.

A distinguished visitor inspects part of the 200-inch telescope mounting in a Philadelphia factory: Prof. Albert Einstein, whose famous theories will be put to new tests by giant "eye."

The glass for the 200-inch mirror as it arrived in Pasadena, Cal., on a special railway carriage. The glass itself weighed 20 tons, the packing 15.

of the universe by the inconceivable distance of a thousand million light years!

The volume of space within the previous range of man's mechanical vision was enlarged eighteen times by the completion of the 100-inch Hooker telescope on Mount Wilson seventeen years ago. This will be multiplied by ten when the 200-inch instrument scans the heavens from the summit of Palomar some six or eight years hence. It will search space to find and photograph unknown astral bodies a billion light years distant from the earth. One light year is the equivalent of 6,000,000,000,000 (six trillion) miles. Multiply six trillion by one thousand million and you have the estimated range of the new tel scope for prying into the mysteries of an u known wilderness of the universe in terms miles!

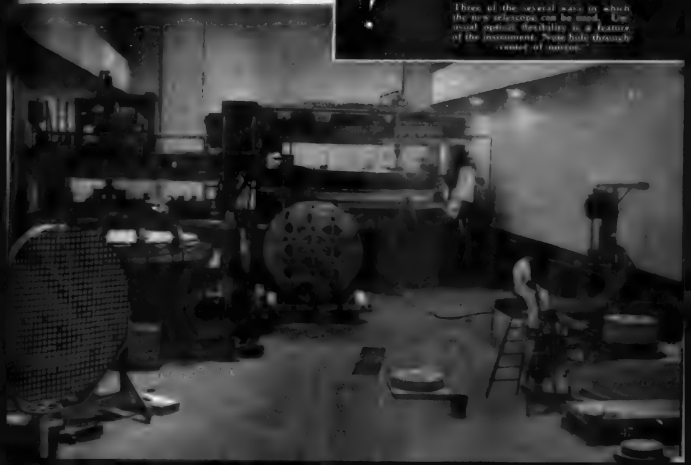
Nine years have elapsed since the Rocke feller Foundation made the funds available t the California Institute of Technology fo carrying this stupendous scientific venture completion. Another eight years will prob ably pass before the great instrument and th mammoth observatory for housing it are com pleted on the summit of Palomar. Why do such an important project move so slowly Well, from intimate contact with astrono mers in the construction and operation of th

100-inch telescope on Mount Wilson, the world-famous Bosscha Sterenwacht te Lembang, at Lembang, Java, and the present 200-inch monster to its present stage of development, the writer has learned not to expect such important scientific work to move like the building of a skyscraper or Boulder Dam.

Astronomers are a race of men apart from others. They are not motivated by financial considerations. They speak a language that sends reporters scurrying through the big dictionary for translations that can be read and understood by newspaper readers. They think in terms of a pure science that staggers human imagination—in light years and the history of astronomy, the world's oldest science. A hundred years of scientific research is as so many days to them. Their own brief lives mean little to astronomy, where there is no time, no beginning to anything—and no end. Another generation of astronomers will carry on from the point where they leave off!

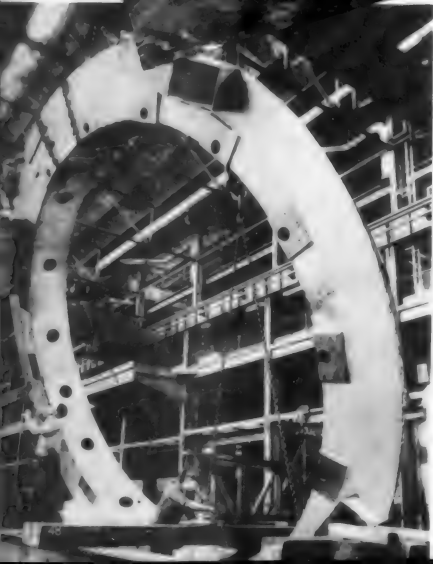
Three great buildings have risen on the Caltech Campus in Pasadena. They have been built and equipped at a cost of more than a million dollars. They are packed with intricate machinery and auxiliary astronomical equipment now being used to find the answers to a thousand and one problems for which

Three of the several ways in which the new telescope can be used. Universal optical flexibility is a feature of the instrument. Note hole through vertex of mirror.



Where the 200-inch mirror is being ground: the special laboratory at the California Institute of Technology, located in Pasadena, California.

The cage for the upper end of the tube which carries the observer's car, shown in special annealing oven. This piece alone, the first part of the telescope actually constructed, weighs 12 tons!



Left: This ring of steel will hold the cell to which the mirror itself will be attached when telescope is completed.

there is no engineering precedent. A 200-inch fused quartz disc was cast at Corning, N. Y., and after being allowed to cool with care similar to that bestowed upon the Dionne quintuplets, was safely delivered in Pasadena. There, in the Caltech optical shops, an estimated four-year task of grinding and polishing will convert it into a concave mirror that is to become the reflector for the giant telescope. The mountings for the telescope, which will weigh 500 tons, including the 60-foot, latticed metal tube, are now being built in the Philadelphia plant of the Westinghouse Electric & Manufacturing Company.

It is interesting to note here that when the construction of the 200-inch telescope was first considered by the California Institute of Technology, the Rocke-

feller Foundation stood ready to provide funds for a 300-inch instrument. When the glass disc for the mirror of the 100-inch Hooker telescope was cast at St. Gobain, France, in 1913, it was considered that the physical limit of size in glass castings had been attained. Since then the process of fusing quartz into Pyrex glass has been perfected to the point that the building of a 300-inch telescope would now be feasible. But astronomers are a type of men who seldom favor bold experiments liable to end in disaster. Thus, after careful deliberation, they decided against attempting to build the 300-inch instrument. The 200-inch telescope, they believe, involves ample pioneering into unknown fields of engineering without such risks of failure as would be certain to arise in the attempted construction of an astronomical monster three times the size of the present world's largest.

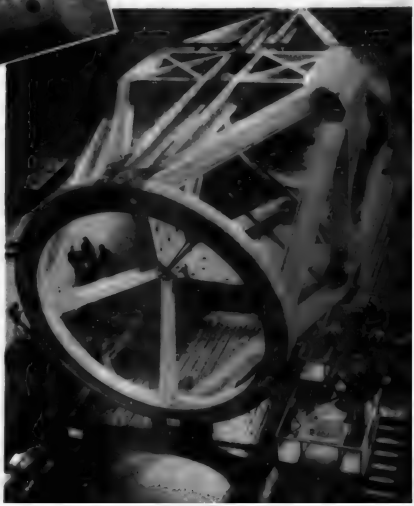
Workmen finishing one of the massive bearings of the declination axis, on which the telescope tube pivots in pointing north and south.

Some idea of such problems may be gained from the fact that a special railway carriage had to be built to transport the 200-inch disc from the factory in Corning, N. Y., to the Caltech shops in Pasadena. The glass is more than 52 feet in circumference —16 feet, 8 inches in diameter. Packing the boxing added several feet to these dimensions. The only possible method of moving such a shipment by rail was to stand it on edge. To do this and insure clearance under bridges and other railway structures the special railway carriage was built with diminutive wheels and an underslung floor. It cleared the rails by only 5½ inches. A study of all transcontinental rail lines then had to be made to find one that would permit the shipment to pass. The tightest squeeze on the route eventually chosen was in Buffalo, N. Y., where the lens box cleared an overhead viaduct by a scant three inches! Due to these track hazards, an inspection train moved ahead of the train carrying the disc. Then the caravan crawled across the continent at a pace never greater than 30-miles per hour. It moved only by daylight. Any sort of a major accident here would have set astronomy back by at least three years, to say nothing of financial loss.

The glass for a 300-inch telescope would be 25-feet in diameter and could never

[*Continued on page* 116]

The gigantic "tube" for the 200-inch telescope, as it appeared at the completion schedules held on April 30, 1937, in the South Philadelphia plant of the Westinghouse Electric Company.



Device Awakens Sleeper With Water In The Face

For stubborn cases, this contraption has proved more efficacious than an alarm clock. When the sleeper refuses to respond to usual awakening methods, cold water usually works.

NOT even an alarm clock and radio will awaken Richard Hess, 21-year-old senior in Columbia College, Columbia University, so he rigged up this odd contraption to overcome his reluctance to get up at 7 a. m.

When the alarm clock sounds, the paste pot weight is released thus turning on the radio and tipping a glass of water perched on a plank over his head, pouring the contents in his face. The glass is tied to the plank so that it will not fall in the sleeper's face and possibly neutralize the refreshing affect of the water. The device starts to operate when a loop tied around the alarm clock key slips off as the key turns.

1927 Car Goes Streamline

IN KEEPING with streamline design, Bernard Pica of 470 South Street, Quincy, Mass., built an advanced streamlined body for his 1927 Chevrolet. The chassis is still "pure Chevrolet" but the body is Pica's own adaptation of the "tear drop" styling. Made of aluminum, the body cost about $100 for materials and required four months to build.

Although the modern commercially constructed car is carrying out the streamline trend, Pica in his design has gone several steps ahead of the most radical 1937 design. The body of Pica's car is placed considerably higher than the usual car.

A new body was built on this 1927 Chevrolet chassis in keeping with the modern streamline trend. Costing approximately $100 for material and built of aluminum, the body took five months to complete.

Bank Gives Drive-In Service

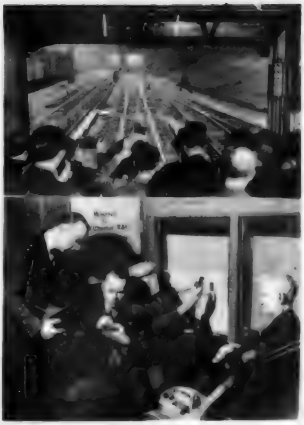
Eliminating the need for patrons to leave cars when transacting business with the bank, this institution has constructed a driveway with windows for customers' convenience.

TO ANSWER the convenience needs of automobile patrons of the Security-First National Bank of Los Angeles, a drive-in branch has been built. At this bank, the patron drives his car into a special driveway along which special windows are available where he may transact his business. After the transaction is completed, the patron drives out through a special exit.

Railroads Run Special Cars For Amateur Photographers

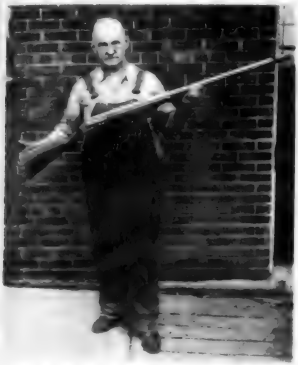
IN ADDITION to their special trains for hikers, bicyclers and other hobby enthusiasts, railroads are now running special observation trains for the accommodation of amateur photographers. Many unusual photos are obtained as the amateurs "shoot" passing trains, entrances and exits from tunnels, sharp curves, etc.

To provide additional material for unusual photos, the railroads permit the amateurs to visit their shops so that locomotives, tenders, cars, and roundhouse equipment can be photographed. The popularity of the idea can be judged by the fact that on a trip to shops of the Pennsylvania Railroad at Altoona, Pa., more than 1,600 amateurs participated.



Amateur photographers secure novel "shots" from observation cars of trains routed for their pleasure (top). Lower photo—Amateurs cleaning their cameras en route to special locations.

Makes Old Rifles As Hobby



Proudly, A. Wagner, of Jackson, Mo., exhibits an old-time muzzle-loading rifle, one of many he has made. The guns are not merely ornaments but are used in shooting contests.

MAKING heavy, obsolete models of old muzzle-loading rifles is the hobby of A. Wagner, a machinist of Jackson, Mo. One of the guns is so heavy that its muzzle must be solidly supported when aimed. The rifles are not merely ornaments, however, for Wagner, an enthusiastic shooter, uses them in competition against modern weapons with surprising success in almost every instance.

All-Wood Kayak Seats Three

PROVIDING ample storage space for duffle and camping equipment as well as seating arrangements for three persons, a new utility kayak has been produced by a New York manufacturer. The craft weighs only 62 pounds and can be transported on the roof of any small auto, being only 12 feet long.

The kayak has a square stern and is made entirely of wood, having a mahogany stem, stern and coaming. The specially designed cockpit is said to remain dry at all times.

This 12-foot all-wood kayak can be used for rowing, sailing, or powered by a small outboard motor. Weighing only 62 pounds, craft can be carried to waterfront on top of an auto.

They're all riding

"HOW many?" the gas station attendant expectantly asks.

"I'm just starting off on a little trip so you'd better fill it up," the rider replies. "Let me have seven cents' worth. And also, fill up the emergency tank." He takes a pint bottle from his pocket and hands it to the attendant.

Only a vehicle capable of making one hundred or more miles to the gallon could make possible such a stop at a gas station. And the motor scooter, America's most modern and personal means of transportation, is the only one capable of maintaining such low fuel costs.

Of course, the high speed of the motor car is lacking. But then, thirty-five miles an hour usually is fast enough. Speedy on the get away, movement through traffic is an experience not believed possible by the average motorist. Also the parking problem is eliminated. In many cases, the scooter can be brought along to wherever the rider is going without undue trouble.

Because of the public's rising interest in scooter use, factories are hard pressed to keep pace with orders. The enthusiasm with which the general public has taken to this new travel means has been supplemented by store owners who find scooters swift and economical for making small-package delivery. A compartment at the rear makes the machine ideally suited for carrying small parcels such as are sent out by drug stores.

Because of its low speed and easy handling, accident danger is reduced to a minimum. When speeding along the highway, the rider's position is such that his feet and legs are easily moved where needed as protection against falling. In some models, the clutch is engaged only when the foot is resting on

Scooters equipped with compartment for holding small packages have opened a new field for these popular vehicles. Because of low operating costs, they are ideally suited for delivery of small and medium size packages.

Ready for a spin ... America's newest mea... of travel. Large balloo... tires tend to incre... riding comfort. Sim... operation and low o... eration costs he... help to make popu... this modern mea... of transportatio...

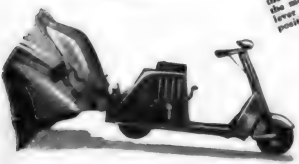
Scooters

the pedal. When the rider desires to stop, the foot is taken off the pedal and placed in position for balancing the machine until it comes to a stop. When necessary the machine may be brought to a quick stop by use of the brakes, conveniently located.

In a survey of state motor vehicle regulations as applied to motor scooters, all those requiring operator's license for car operation also required them for scooters. Registration certificates also are required before the scooter can be operated.

A motor scooter with engine enclosed. Low cost operation has been largely responsible for widespread use of motor scooters. With fuel consumption at a rate making possible 100 or more miles to the gallon, the machines have universal appeal.

One of the many motor scooters, showing general construction details. The gas tank is fastened to the frame just ahead of the motor. The starting lever is in a convenient position for left hand use.



For persons who wish to take their scooter with them on long trips a special attachment makes it possible to attach them to the rear of the car in the same manner as a trailer.

The popularity of motor scooters has received an added boost from the fact that they are able to travel along narrow lanes, and even wooded paths, a feat that can be duplicated by few other powered vehicles with the possible exception of the motorcycle.

The popularity of the hobby trains which leading railroads have been running to cater to cyclists, camera fans, canoeists, etc., may soon result in the operation of trains to special scenic points at which the passengers can leave the train and travel on country roads upon motor scooters provided and rented by the railroad. Without a doubt, such trains would be booked for reservations weeks in advance.

Another factor that tends to increase the popularity of motor scooters is the operation of "rent-a-scooter" booths at parks and amusement centers by concessionaires.

Portable Lorry Loader Hoists Loads Up To 10 Tons

This portable gantry-type lorry loader can be set up or taken apart within two hours at any work site. Its use enables complete car loads to be placed aboard lorries in minimum time. Heavy cables tilt the gantry and lift the load

A PORTABLE lorry loader capable of lifting loads of 10 tons has been developed by a German manufacturer. The entire loader can be set up or taken apart within two hours, making it particularly adaptable for jobs like lumbering where the lorries must pick up heavy loads at isolated spots in the woodlands.

The loader consists of a tubular metal power gantry equipped with grooved wheels over which heavy wire cables pass to a metal frame and chains which serve to lift the load. Special box-like frames are filled with lumber while placed on the ground. Upon being filled, the box frames are hoisted and placed aboard a lorry. The loader is equipped with lights so it can be operated at night. Only one man is needed to operate the gantry's power unit and cable wench equipment.

Synthetic Horsehair Created

RECENT experiments prove that synthetic horsehair can now be made from coconut fiber by a process patented by Owen Tudor-Hart, a London inventor. The process will enable the coconut fiber to be used in making many articles now requiring the increasingly scarce and correspondingly costly natural horsehair.

The synthetic product is made by first cooking the fibers under three atmospheric pressures in a three per cent solution of caustic soda. After drying and dyeing, they are run through a crimping machine which leaves them springy and resilient.

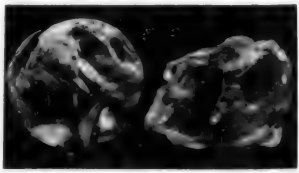
Plastic Produces Quartz Effect

AN INTERESTING demonstration showing the comparative refractive qualities of Lucite, a newly developed plastic, and rock quartz crystal was given before members of the New York Patent Law Association.

A mass of the thermoplastic resin, internally fractured, and a like formation of quartz crystal were each placed over a source of illumination that projected, through filtered glasses, yellow, green, blue and violet light. Having the same property of propagating light and because the internal fractures were at various angles, the two masses reflected the light from their interior surfaces at a myriad of angles.

As reflected, the light beams struck one another and combined to make a beautiful mixture of constantly changing colors in which the light beams appeared to travel sometimes in waves, sometimes as if tracing a path along a fine line in the crystalline or plastic structure. Alternate fading and glowing and bursts of color were also noted.

The demonstration indicates that the plastic seems to have the same structural formation as that of rock quartz crystal as far as optical qualities are concerned.



Demonstrating comparatively similar refractive qualities, a mass of Lucite, a newly developed plastic (left), and rock quartz crystal reflect light beams in a myriad of angles

New Burglar Alarm Uses Radio

A BURGLAR alarm capable of broadcasting its message to radio equipped police within a 15-mile radius is the invention of James Howton, middle aged electrician of Milton-Freewater, 13 miles from Walla Walla, Washington.

Connected with windows and doors of the building being protected, the device starts its calls for help even before the burglar has entered the building. Any attempt to force a lock or break a window starts this silent watchman on its calls for help.

The invention consists principally of a short wave radio transmitter and a phonograph whose record message is transmitted when an attempt is made to enter the building.

To give fire protection, the machine is equipped with a thermostat which is turned on automatically and plays another record, whenever the heat in the building rises above any designated point. This record announces that there is a fire and gives the address. The transmitter is battery operated so that if the power lines leading into the building are cut, it will continue to operate.

James Howton (right), and his burglar alarm which uses radio to summon police when an attempt is made to enter building protected by this device. Operating on the short waves, the transmitter sends out a verbal announcement when building is being entered. Transmission starts when burglar tampers with doors or windows.

Seven years ago Howton began work on his invention because he believed that radio was to play an important part in the apprehension of criminals.

His first idea was to connect a radio transmitter with an alarm system so that code signals could be flashed on the air if any person attempted to break into a building protected by his device.

As the years went by he perfected the code machine. He saw, however, that inexperienced prowl car operators might become confused in receiving code signals. He then went to work on an electrical transcription attachment which would play a record whenever disturbed.

The transmitter is crystal controlled and uses 11 tubes. The output is 20 watts. It has been demonstrated before the Oregon and Washington state police, as well as before the police departments of Portland, Seattle, Tacoma and Spokane.

Plant Operates Under Water

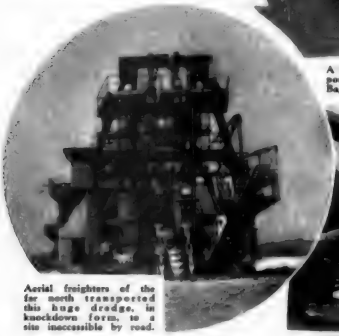
A HYDRO-ELECTRIC power plant built entirely under water is the new and unique boast of the town of Rostin in Pomerania. There is no power house on the bank, no visible structure anywhere; everything lies in midstream below the dam, and the electricians come and go through tunnels.

In order to exploit fully a low head of water, the axes of the turbines are not set vertically as in most hydro-electric installations, but are almost parallel with the direction of the current.

AERIAL FREIGHTERS SERVE MINERS

Planes remove barrier of inaccessibility.

A bulky steam engine frame is loaded aboard a metal transport plane to be flown to a distant Canadian mine. Below—Bags of radium ore ready to be rushed to a processing plant.



Aerial freighters of the far north transported this huge dredge, in knockdown form, to a site inaccessible by road.

AIRPLANES provided with large loading hatches and capable of carrying five-ton payloads are transporting entire mining plants into virgin territory of Northern Ontario, Canada. Once a paying property has been located, diamond drills, steam boilers, and even dynamite are loaded into planes and rushed to the spot.

A few years ago, mining machinery, always bulky and hard to handle, could be taken into mining country only after roads had been constructed at great expense. For this reason, many mines had to be abandoned. Today, not only mining machinery, but huge dredges are shipped by air in knockdown form, to be quickly assembled at the scene of operations in the backlands.

Medical science, too, benefits from the use of aerial freighters. Radium ore secured at Great Bear Lake is rushed by plane to a plant at Port Hope, Ontario, where the radium is extracted and made ready for its valuable service to humanity.

A wing flap facilitates the loading of a large gear wheel (bottom). Above—An improvised sapling gangplank is used for loading heavy pump assembly aboard a Fairchild seaplane.

Metal "Ears" Locate Sounds In Fog Or Darkness

DESIGNED to pick up and magnify the sound of horns, sirens, and lightship bells during fog or darkness, a new sound direction finder for ships has been developed by a Viennese manufacturer. Outstanding features of the device are two metal "ears" mounted on a swivel by means of tubular arms.

To operate the sound finder, a ship's officer places his ears against pneumatic rubber pads attached to the tubes leading from the metal "ears." Turning the device in various directions, the officer quickly reaches the point where he can hear the tolling bell or siren with equal intensity in both ears. The range of the apparatus depends on the size of the "ears" which are ellipsoids in shape.

Mounted on a swivel, the metal "ears" of this sound direction finder can be swung in any direction, enabling ship officers to determine the location of fog-hidden sirens, horns, etc.

Conveyor Speeds Shoeshine

Conveying its cargo of eight customers past six attendants, each specializing in one shoeshining operation to eliminate lost motion, this rotary conveyor unit speeds up work.

CONSISTING of a rotary conveyor seating eight persons and an elevated platform with steps for ascending and descending, a new shoeshining service unit has made its appearance in St. Louis, Mo. Better and quicker shines are said to be provided through use of the unit.

After mounting a seat from the ascending side of the platform, the customer is slowly conveyed past six attendants who stand behind the machine and successively perform the various shining operations. An electric motor powers the conveyor.

Settee Resembles Old Wagon

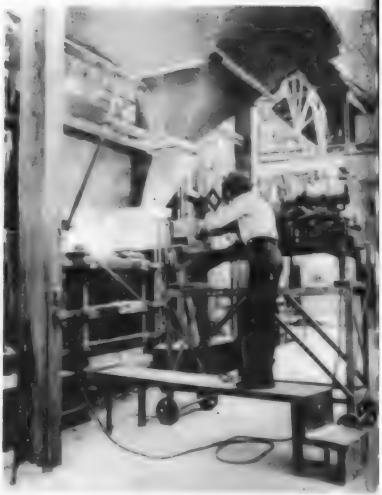
RESEMBLING a covered wagon of early pioneering days in appearance, a novel lawn settee drew much attention at a recent home-furnishing show in Chicago, Ill. A wooden chassis mounted on springs attached to wooden axles and wheels serves to hold a comfortable mattress and cushions, while a sun shade is provided in the form of the wagon's canvas roof. A short wooden "tongue" attached to the front axle enables the settee to be towed.

Novel in appearance, this "covered wagon" lawn settee is comfortable as well, due to the wagon-type springs and soft mattress. Note the genuine old-time buggy lantern.

MECHANICAL

Age-old art of lung-powered glass blowing gives way to puffing, snorting robots of almost human intelligence, capable of turning out 115 bottles a minute.

by
Harold L.
Zimmer



Right—Looking into "dog house" part of furnace. By holding a piece of blue glass in front of the eyes, it is possible to see the inside of the furnace and watch the hot glass cook and boil. Without the blue glass, the inside of the furnace appears to be only a yellow glare. The inside temperature is maintained at 2,600 degrees F.

Below—Double molds used in bottle manufacture. To the right is the thick mold which roughs up the hot glass—just enough to make the bottle needed. This partially molded glass then is transferred to the finish mold, where compressed air blows soft glass to desired size and shape. Finish mold then swings open and bottle is deposited on conveyor which takes it to tempering room.

HAVE you ever picked up a soda or medicine bottle and wondered just how anything so perfect could be turned out in such huge numbers? Perhaps through your mind has flashed the heroic picture of countless, ruddy-cheeked men, industriously blowing away on long tubes, the respective ends of which are covered with round, glowing balls of hot glass.

If so, change all your past conceptions. Glass and bottle-making has changed with everything else, in this scientific age. Huge, spider-like monsters veritable *robots*, now puff and snort, throwing out to the belt conveyors as many as 115 bottles per minute! Imagine one machine doing that—faster than you can count! And each bottle is perfect—it has to be.

Were you ever through a bottle-making plant? Then

ARTISTS BLOW

A detailed photo of the bottle making machine. More than 10,000 separate parts make up this machine, which is capable of operating with almost human intelligence. It is careful and gentle—handling delicate, half-cooled bottles so easily that they are not even jarred—yet with strength enough to toss fifteen elephants around by their tails. Up to 115 bottles a minute are turned out.

GLASS BOTTLES

let's go through one of the world's largest. Here we'll find the answer to all our questions and learn many interesting things as well.

If you wish to start from the cellar and work up, we'll see just where it all begins:

A flat-car on a siding is unloading fine, white silica sand. Another, soda-ash and another lime. These are the main ingredients. Each is carefully stored in overhead bins.

Below each bin opens a funnel-like mouth, with a heavy trip valve and an automatic scale arrangement which shows how much material is being poured. Underneath the bins runs a regular trolley track and car. We see a car approaching; first, the man operating it stops beneath the bin labeled "soda-ash." He pulls the lever and watches the scale to see that the proper amount is poured. Next, he runs the car to the bin, "lime"; then, on to the sand. We might say that "cullet" (broken glass) is also added to the mixture. This is necessary to give the bottles greater strength and purity. If enough cullet or waste is not available, the glass manufacturer often has to buy it from outside sources.

After passing through several mixing operations, the raw material is transported on overhead trolleys to the "batch-bins," which are directly over the mighty melting furnaces. As the material, or batch, is needed, it is poured into the mouth of the furnace. Let's climb down, now, to the factory proper.

The point where the raw material enters the furnace is called the "dog-house." Through a small peep-hole, a workman allows us to glimpse at the seething, bubbling inferno inside. At first, we see nothing but a yellow glare. The workman smiles: "Here, take this, "and he hands us a piece of blue

[*Continued on page 120*]

He Was An

William Dubilier now has more than 300 patents and is still active.

His invention of the mica condenser, now universally used in radio and electrical circuits, made Dubilier internationally famous. Here he is pictured with the largest mica condenser ever built—a giant designed for a 350 kilowatt radio transmitter.

A SNEAK thief who had been terrorizing residents of New York's famed lower East Side unwittingly started the son of one of his victims on a career of invention that has made the boy's name a by-word in the world of science. Only ten years old at the time, the youth already knew how a high-voltage spark coil worked and how to hook it up. When the thief made the mistake one night of trying the family's door knob, he screamed with pain at the first touch and found he couldn't let go. That ended a one-man crime wave and made young Bill Dubilier the hero of the neighborhood.

The forty fruitful years that have passed since the episode of the "shocking door knob" have proved that the boy was no mere infant prodigy. More than three hundred patents, honors from many scientific organizations, official recognition by many governments, all testify to his inventive genius and amazing versatility.

To anyone in the radio or electrical field, the word Dubilier is virtually a synonym for condenser. In 1910 the condensers universally used in radio transmitters were cumbersome Leyden jars, which had undergone practically no change in design since their appearance in 1745. Dubilier did away with the glass bottles and substituted for them thin sheets of mica. These new mica condensers proved so superior to the common Leyden jars that the latter disappeared completely. Millions upon millions of mica condensers, ranging in size from one-half-inch square to the giant pictured here with its inventor, have been produced in factories all over the world.

In 1910, when Dubilier was only twenty-two years old, his pioneer experiments with wireless telephony attracted international interest. He was invited to visit Russia with his instruments and spend a year there. He lived in the Czar's palace in St. Petersburg, where he installed the first wireless telephone in the country. He made another installation in one of the winter palaces in the city of Viborg.

For this spectacular work, Dubilier was promised a small fortune. However, being young and altogether unfamiliar with the character of the grafting satellites who composed the royal court, he found himself practically penniless in the Russian capital at the end of his visit. He actually had to borrow money to buy his return passage.

It is not generally known that William Dubilier operated the equivalent of a broadcasting station as early as 1909. At that time, he was experimenting with a wireless telephone transmitter in Seattle, Washington. Getting tired of shouting continually into a crude microphone while other engineers received his signals at distant points, Dubilier devised what we would now call a phonograph pick-up. He attached this to the tone arm of the old style talking machine and played whatever records he was able to find. Very quickly he was flooded with letters from operators on ships at sea and at Canadian Government stations, who reported in great amazement their reception of music, jokes, vaudeville

Inventor at 10!

by Robert Hertzberg

patter, songs, etc. This impromptu entertainment was greatly welcomed by the operators, who wore heavy, uncomfortable earphones for hours at a time.

The novelty of receiving music through the air appealed to the owner of an amusement park in Seattle. He fitted up a crude receiving set and erected a sign reading, "Listen To The Wireless For Ten Cents." Strangely enough, every time that Dubilier visited the amusement park and attempted to listen in, he was told that the apparatus was out of order. The receiver was working, but there was no music to pick up, for the simple reason that Dubilier was not at the transmitter to operate it!

When the World War broke out a few years later, the young inventor had more opportunity than ever to exercise his abilities. He devised a means for locating submerged submarines and calculating their speed and direction, an idea that proved extremely valuable to France and Great Britain. Before the United States entered the War and before airplanes were even dreamed of as military weapons of any importance, Dubilier demonstrated to his own government the practicability of wireless communication between airplanes in flight and the ground.

Strangely enough, William Dubilier had originally planned to become a lawyer. However, when he learned that law degrees were comparatively easy to obtain and that lawyers were a drug on the market, he decided to follow his natural inclination to experiment with electrical circuits and gadgets. He was that unusual person—a good business man as well as a good inventor—and by the time he was fifteen, he

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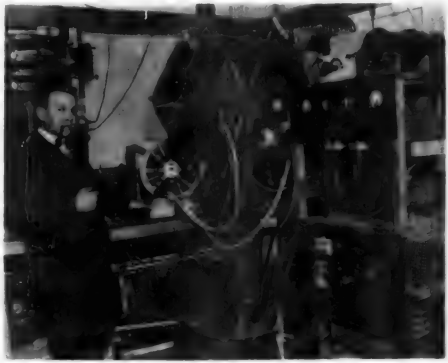


Above right: William Dubilier as he appears today; picture was posed specially for MODERN MECHANIX. Right: Although he now has unlimited laboratory facilities such as these at his command, Dubilier well remembers his boyhood tribulations with crude and often home-made apparatus, and he encourages young experimenters to continue their efforts no matter how small their cellar "labs" may be.

W3XFE TRANSMITS ON ALL WAVELENGTHS

THE nation's most unique radio station, which has the only permit ever granted by the Federal Communications Commission to transmit continuously on all radio frequencies, is in operation at Kensington, Maryland. Known as special experimental station W3XFE, the all-wave transmitter sends only to itself, using special apparatus.

Scientists of the Carnegie Institution of Washington are using the apparatus to bounce radio waves off the electrically-ionized layers scores of miles above the earth's atmosphere. A study of the radio reflecting layers is disclosing new facts about radio transmission, magnetic storms around the earth, particle emissions from the sun and magnetic storms on the sun itself.

Dr. L. V. Berkner, Carnegie Institution scientist in charge of radio reflection studies at Kensington, Md., adjusts the transmitter of special experimental station W3XFE, the only station licensed to transmit continuously on all frequencies of the radio spectrum.

Shown above is the automatic tuning panel of the nation's most unique radio station which electrically interlocks the station's transmitting and receiving units, tuning in the signals which vary from 516 to 16,000 kilocycles.

The radio pulses shot upward to the radio layers of the ionosphere by the Carnegie station are modulated at the rate of only ten cycles per second. Since this is below the lower limit of frequencies which the ear detects as a low-pitched note, the signals —even when heard on the special receiver of the station—are only a series of clicks.

The Carnegie station continually changes its frequency from 16,000 kilocycles to 516 kilocycles, passing over its entire range every 15 minutes. An automatic tuning panel continuously tunes the station's receiver to receive the ever changing signals sent by the transmitter.

The signals transmitted are of a special kind having what radio engineers call extended sidebands. An ordinary receiver is designed to cut off most of them, while the Carnegie station receiver is built so that it is especially sensitive to them. Thus W3XFE, while transmitting continuously, lives in a radio world all its own.

Reception of the signals reflected from far above the stratosphere is made on a photographic recorder which makes a continuous and permanent record of the height at which any given frequency of signal is reflected. A special antenna directs the greater portion of the liberated radio energy directly upward.

The experiments may lead to a solution of radio fading which has been attributed to an electrically-ionized "Heavyside" layer situated miles above the earth's surface.

Portable Aviation "Lighthouse" Uses Dry Batteries

PRODUCING light signals that are visible for five miles, a new type of portable "lighthouse" for aviation use has been developed. Entirely self-contained and operated by dry batteries, the device eliminates the necessity of installing and maintaining electric power-line wires.

Using a battery potential of but one and one-half volts, 8,000 volts are produced by a spark coil to operate a spiral neon tube of five-foot length. The entire mechanism is ruggedly built and sealed against weather conditions to insure long life.

A battery unit composed of 18 one and one-half volt cells automatically operates the light 24 hours a day, flashing 120 times per minute, for a minimum period of six months. When battery potential begins to fall, the device switches to a reserve battery and operates for another six months.

Powered by two sets of dry batteries, the coiled neon tube of this portable aviation "lighthouse" can flash 120 times per minute for an entire year without attention.

Midget Skis Set On Rollers

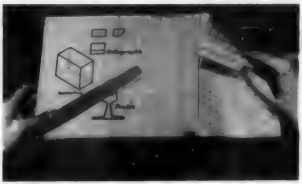
Providing plenty of thrills, midget skis equipped with rollers have created a new sport—"ski skooting". Propulsion is achieved by means of two rubber-tipped ski poles.

COMBINING the best features of skiing and roller skating, a new sport of "ski-skooting" has developed through the adaptation of midget skis on rollers. Two rubber-tipped poles are used to propel the skier along the pavement. The midget skis are fastened to the user's feet by means of stout straps.

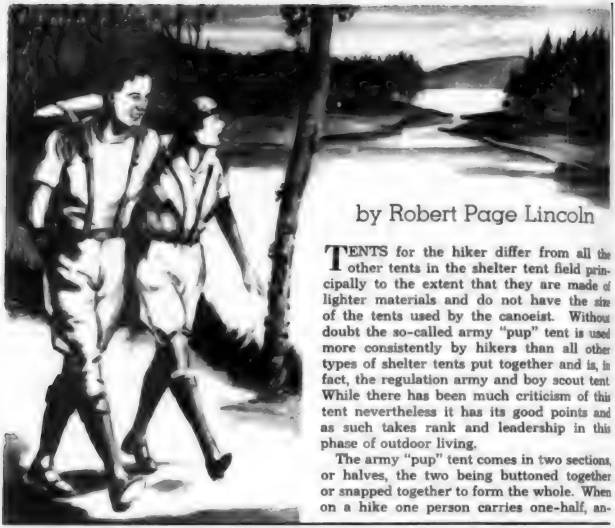
Sketch Pad Eases Work

OBTAINABLE in pads of 200, 100, or 50 sheets of varying sizes, a new sketch pad set is intended for making any type of sketch to any desired scale. The set consists of a pad of strong tracing paper, a cellulose-covered buff guide plate that slides under the top sheet of the pad, and a steel straight edge.

The sheets of the pad are made up with squares, dots, and lines of varying thicknesses so that scale drawings showing all sides of an object can be made.



Through use of this compact sketch pad set, it is possible to make any type of sketch to any desired scale. The pad sheets have special squares, dots, and lines on each side.



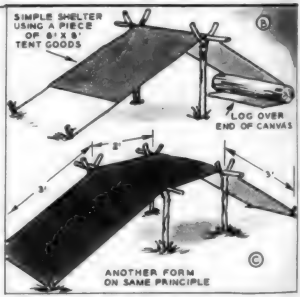
by Robert Page Lincoln

SHELTER TENTS

TENTS for the hiker differ from all the other tents in the shelter tent field principally to the extent that they are made of lighter materials and do not have the size of the tents used by the canoeist. Without doubt the so-called army "pup" tent is used more consistently by hikers than all other types of shelter tents put together and is, in fact, the regulation army and boy scout tent. While there has been much criticism of this tent nevertheless it has its good points and as such takes rank and leadership in this phase of outdoor living.

The army "pup" tent comes in two sections, or halves, the two being buttoned together or snapped together to form the whole. When on a hike one person carries one-half, an-

Comfortable and more superior shelter is assured the hiker who can afford the more complete wedge-type tent as shown above. The ridge of the tent can quickly be attached to a rope which, in turn, is strung to an overhanging tree limb.

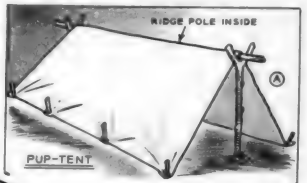


Two types of simple and primitive hikers' shelters are shown in drawings B and C. Inasmuch as crotched sticks and a log can be secured at almost any campsite, the hiker need only carry the single sheet of canvas, 6 x 8 feet in size.

other the second half, thus making it possible to cut down on the weight of the same to a mere fraction. It is a matter of but a few minutes to join the two halves and erect the tent. It will be found that by using an inner ridge pole and two crotched sticks for uprights (drawing A) one will have better results than with the jointed poles that come with the tent.

The inclination of some hikers to get along with very primitive shelter is easily understood. In the drawings B and C will be noted two ideas that can readily be carried out with a simple piece of tent goods or canvas. The canvas piece in this instance is simply 6x8 feet in size. In B a log is used as a back to the tent, the canvas being tucked under the same or rolled on. A down tree will be equally as good. Two crotched sticks, as shown, support the ridge pole, and two guy ropes out in front keep the canvas stretched. This makes an excellent roof overhead.

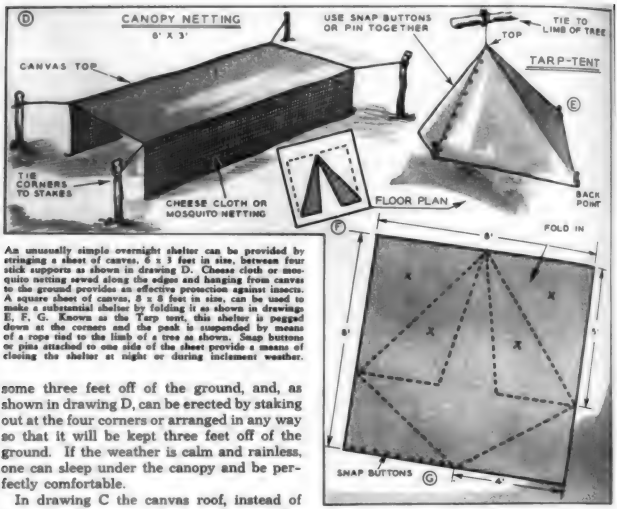
Mosquito netting is used in combination with this type of tent, but is stretched over the head of the sleeper rather than gathered all around the edges of the tent or roof canvas. With a roof such as this overhead one can use a netting canopy very nicely. This is easily made by obtaining a piece of light canvas, 6x3 feet, and sewing in mosquito netting or cheese-cloth all around the edges of the same. The netting or cheese-cloth should drop down to the ground in loose folds all around. The canvas top should stand



Probably the most popular hikers' shelter tent, suitable for two persons, is the army "pup" tent. It comes in two sections that are buttoned together. Although supplied with jointed poles, many hikers prefer to erect it by using a ridge pole supported by two crotched sticks as shown in drawing A.

FOR THE HIKER

Few memories linger as long as those of hiking days—a good tent, crackling fire, and congenial companions. Right—An "umbrella" type tent with a sewed-in floor is the choice of many hikers. Its center pole support enables it to be erected quickly and ample space for two persons is provided.



An unusually simple overnight shelter can be provided by stringing a sheet of canvas, 6 x 3 feet in size, between four stick supports as shown in drawing D. Cheese cloth or mosquito netting sewed along the edges and hanging from canvas to the ground provides an effective protection against insects. A square sheet of canvas, 8 x 8 feet in size, can be used to make a substantial shelter by folding it as shown in drawings E, F, G. Known as the Tarp tent, this shelter is pegged down at the corners and the peak is suspended by means of a rope tied to the limb of a tree as shown. Snap buttons or pins attached to one side of the sheet provide a means of closing the shelter at night or during inclement weather.

some three feet off of the ground, and, as shown in drawing D, can be erected by staking out at the four corners or arranged in any way so that it will be kept three feet off of the ground. If the weather is calm and rainless, one can sleep under the canopy and be perfectly comfortable.

In drawing C the canvas roof, instead of being guyed out as in B, comes down to the ground on either side and is pegged down. Instead of having one ridge as in B there are two ridges, forming a flat surface, or nearly so, sufficient to permit the water to run off and not stand on the central top.

The possibilities of using a square piece of canvas to make a shelter are emphasized in the drawings E, F and G. Obtained in light Sea Island cotton (so-called balloon-silk) or other light cloth, it will weigh but little in an 8x8-foot size. Understand, with regard to making a tent out of this square piece of canvas, it is made up into a tent right on the spot.

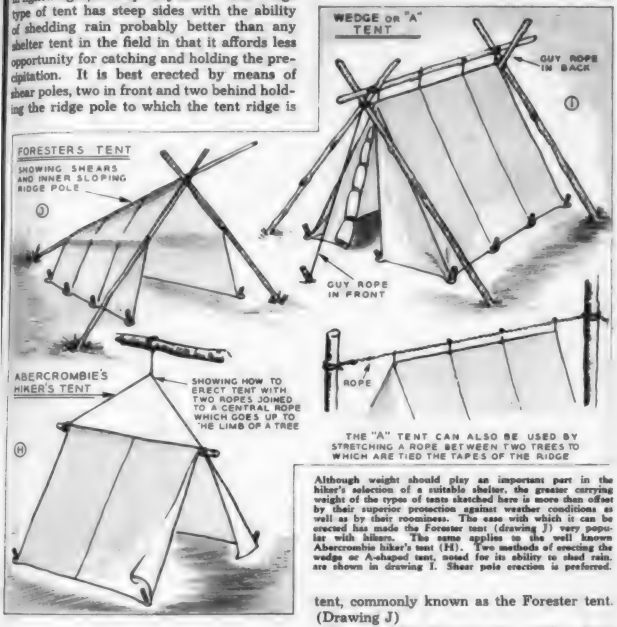
In operation, the corners marked X are folded in under to lie on the ground. This gives something of a sod cloth on the ground over which the ground or floor canvas or a poncho can be laid. As will be noticed, two ropes are pegged down, connecting up with a central rope, the same going up to the limb of a tree. Over this the Tarp tent or sheet tent is made. If desired, your tent maker will arrange snap buttons to snap the two front edges together or they can be pinned together. There are many designs and possibilities in the Tarp sheet idea of a tent, and this is only one of them. It may be stated that this was undoubtedly the first move in the making of the celebrated Forester tent.

Of the tents that are ready made up and which are much favored by the hiker there are several. One of these is the Abercrombie hiker's tent. This tent, like the "pup" tent, divides into two halves, the same taping together at the ridge to make the whole. This tent comes in two sizes, one having a ground area of 5x7 feet and a 3½-foot height, while the other is 6x8 feet, and is 4½ feet high. They weigh around 3½ and 4½ pounds respectively. With each hiker carrying half of the tent, the weight is further reduced. A very simple method of erecting this tent is shown in the drawing H. Here the ridge stick or pole has a rope at either end coming up to meet a central rope which, in turn, goes up over a tree limb and is so held in place. This idea of erecting a tent can be used in putting up other tents of a like type where the ridge is short.

The so called wedge or "A" type tent in a 6x7-foot size as to floor measurement, 7

feet high, is an excellent recommendation for a hiker's tent for two, if you want a tent with room to turn around in and in which you can store your packsacks at night. A tent of this type will weigh about six pounds in lightweight, best-quality cloth. The wedge type of tent has steep sides with the ability of shedding rain probably better than any shelter tent in the field in that it affords less opportunity for catching and holding the precipitation. It is best erected by means of shear poles, two in front and two behind holding the ridge pole to which the tent ridge is tied. While it is possible to use a rope between two trees, this does not thoroughly stretch the canvas along the ridge and it will sag. In drawing I, the method of using shear poles or a rope ridge is shown.

Many shelter tents though fitted for the canoeist or where transportation is not a matter of serious consequence, do not answer for the purposes of the hiker who carries his all on his back. Listed among such are the so-called Explorer's tent, the Canoe tent, the Hudson Bay tent and the Cruiser tent. Both the hiker's tent and the wedge tent, however, are worthy of careful consideration in this class. The extreme lightweight tent is a rank delusion at best, although one shelter tent in this light-weight class seems to fit pleasingly into the picture, namely, the Warren Miller tent, commonly known as the Forester tent. (Drawing J)



Although weight should play an important part in the hiker's selection of a suitable shelter, the greater carrying weight of the types of tents sketched here is more than offset by their superior protection against weather conditions as well as by their roominess. The ease with which it can be erected has made the Forester tent (drawing J) very popular with hikers. The same applies to the well known Abercrombie hiker's tent (H). Two methods of erecting the wedge or A-shaped tent, noted for its ability to shed rain, are shown in drawing I. Shear pole erection is preferred.

A tent of the Forester type, with a front width of 7½ feet, and 7½ feet from front to back, coming in the best grade of "silk" cotton, has a weight of only 3½ pounds. Because of this lightness, its excellent design, and the relative ease with which the tent is erected, the Forester has been the pick of many hikers and go-light camping fans for years. Probably it is far better known in the eastern half of the United States than anywhere else, being a familiar sight from the Adirondacks of New York to Maine and New Brunswick.

[*Continued on page* 142]

Cardboard Flying Models Produced In England

CARDBOARD model airplanes possessing flying qualities equaling those of models made of balsa wood and tissue paper have been produced in England. Created by Wallis Rigby, noted English artist and designer of scale models, the unusual flying craft are produced both in booklet and flat sheet forms.

No hand cutting of the brightly colored cardboard forms is required in constructing the models, every part being accurately punched to shape. A perfect fitting of the more delicate pieces is assured when they are detached from the forms. Aerodynamically stable, the models feature rubber strand motors, and long, graceful flights are obtained.

Resembling real airplanes as they speed through the air with propellers flashing, these unusual cardboard scale models (above and right) are powered by small rubber motors.

Wallis Rigby (left), well known English artist and designer of scale model cardboard airplanes, prepares to launch one of his novel aircraft at a London playground.

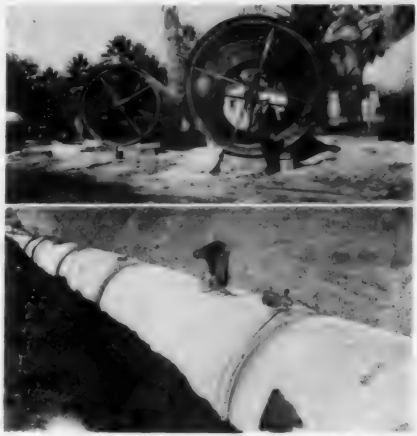
Although made of cardboard, the models created by Rigby are of strong construction. As this photo shows, a weight of several pounds fails to bend the wing section.

Gigantic Steel Pipe Line Extends 10 Miles

THE world's largest steel welded pipe line, having a diameter measuring up to eleven feet, six inches, is located at Arlington, California.

More than ten miles in length, the pipe line has a capacity of 500,000,000 gallons every 24 hours. The pipe is protected against corrosion by a ¾-inch coating of "gunite" on the outside and a $\frac{1}{32}$-inch layer of enamel on the inside. The enamel is a coal tar product and is applied at a temperature of 475 degrees F. When cool it gives a tough, protective coating.

Each joint, lap welded, is given a soap test by forcing soap suds, made from liquid soap, into the joint between laps. Hydrostatic pressure of 80 to 90 pounds is maintained for five minutes while inspectors, inside and outside the pipe, look for leaks. This pipe line is part of California's aqueduct system.



Above—Pipe line sections showing size comparison to a man. Below—A portion of the 10-mile line with workman testing joint by means of soap suds under 80 to 90 pounds pressure.

New Tool Cuts Hot Rolled Steel At High Speed

Workman using "mighty midget," capable of cutting hot rolled steel at speeds up to 15 feet a minute. It weighs but seven pounds and makes 2,400 shear cuts per minute.

KNOWN as the "mighty midget," a new metal cutting shear cuts up to 18-gauge hot rolled steel and follows any line accurately. Clean cutting of metal without burrs or distortion is made possible by 2,400 shear cuts per minute. Weighing but seven pounds, the machine will operate at speeds up to 15 feet a minute. For circular cutting, it will operate in a radius as small as one inch.

The tool will cut such materials as galvanized iron, brass, copper, tin, aluminum, stainless steel, fibre, wire lath, hardware cloth, screen wire, asbestos, canvas, felt linoleum, black iron and blue annealed sheets.

It is particularly suitable for the making of such things as ventilators, air ducts, machine guards, corset patterns, shirt patterns, signs and letters, ice box lining, soda fountains, metal boats and sinks, airplanes, auto bodies, fender wells, stoves, patterns, templates, elbow sections, radiator covers, radiator enclosures, shelving and lockers.

STAMPS for

by Beach Conger

ENGINEERS, scientists and mechanically-minded persons whose hobby is stamp collecting have found that they can easily combine their professional and philatelic pursuits to build up prize-winning collections and exhibits. Specialization, for a long time the dominant factor in industry, has become the keynote of philately as well. A mere collection of stamps *per se*, no matter how attractively laid out on album pages, can not compete with the specialist's group of adhesives which are supplemented by a competent write-up, pictures and other relevant information.

Today the emphasis in stamp collecting lies in the study of the stamps and postmarks, their historical background and the events connected with their issuance. Even as the American collector, by virtue of this new shift in philately, has an immediate advantage over foreign competitors when showing his well documented United States collection in an international exhibition, so the engineer has at his fingertips a mine of information which enables him to outstrip his competitors in several fields.

In recent years the collecting of airmail stamps and covers has increased by leaps and bounds until, on the recent first flight to China, no passengers could be carried because the plane was loaded with philatelic mail on both east and west-bound flights. Nearly 100,000 letters deluged the Hong Kong post office when the clipper unloaded the first mail from San Francisco, letters representing airmail collectors all over the world. The development of aviation is a theme which the scientist-collector is eminently fitted to develop by means of his stamps.

Such a collection may entail comparatively little financial outlay. It can also be compiled at great expense, depending upon the resources of the collector and his choice of method. Whether expensive or cheap, however, the collection should start with the two stamps issued in 1928 by the United States in commemoration of the Wright brothers' first flight near Kitty Hawk in 1903. Their famous airplane is shown on the two-cent denomination.

Copies of these two stamps may be purchased used for as little as fifteen cents. The collectors with more ample means will probably buy them used and unused, in blocks of four with plate numbers and possibly will add a first-day cover, a letter posted on the first day the stamps were issued. But in the matter of writing up these items and presenting them attractively, it's every man for himself.

He may wish to compare the first crude Wright biplane with that pictured on the second stamp to be added to the collection, a French issue picturing the equally crude monoplane in which Louis Bleriot flew across the English Channel in 1909. This second important step in the trail blazed by the pioneers, which has brought us to the Martin and Sikorsky luxury clippers, has been commemorated by France on its airmail stamp of 1934, another item which can be bought for a little more than a dime.

At this point the airmail enthusiast must decide whether to limit himself to the relatively inexpensive field of stamps alone, supplemented by occasional covers, or to embrace the more expensive group of covers. If he is able to afford the latter, there are innumerable pioneer covers, flown at a time

when people were still shaking their heads and saying, "It can't be done." The first American airmail pilot was the famous Earle L. Ovington, who conveyed souvenir postcards and letters in his Gnome-powered Blériot from the Nassau airdrome to the Mineola, L. I., Post Office during the International Aviation Meet of 1911. Shortly thereafter Calbraith Rogers accomplished a trans-continental flight—in fifty-five days! He, too, carried letters in his Wright biplane, yet only a few are known to exist. The airmail collector may derive some idea of the wealth of material available for his write-ups from the fact that there were ten pioneer flights in 1911 and forty-one the following year. The covers range in price from $20 up into the hundreds. Not until May, 1918, was the first regular airmail established.

Soon after the finish of the World War, the first of the trans-Atlantic air races started with an offer of $50,000 by the "London Daily Mail" for the first successful flight. The Vickers-Vimy bomber, in which Alcock and Brown completed their prize-winning hop, may be seen on the fifty-cent stamp issued by Newfoundland in 1931. When they landed at Clifden, Ireland, Captain Alcock exhibited a package of rain-soaked letters to officials there and calmly said, "I am the first trans-Atlantic postman." Although these covers command high prices, the collector can secure one of the stamps issued by Newfoundland for that particular flight for a few dollars.

Since that epoch-making oceanic dash, which ended with the plane tipped on its

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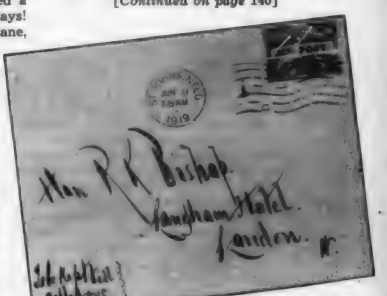

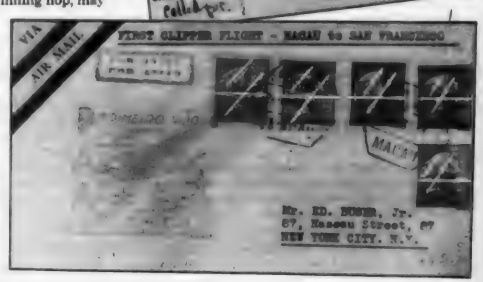

Above right—One of the first trans-Atlantic airmail letters, carried in 1919 by Alcock and Brown in their epoch-making flight from Newfoundland to Ireland. Right—One of the covers flown on the trans-Pacific China service. A first flight cover, it was carried from Macao, a Portuguese colony near Hong Kong, to San Francisco, where it arrived one week after it was mailed in Asia. Top of page—Stamps issued in honor of world famous men.

Model Stratosphere Airship Is Propelled By Air Currents

Currents of air, generated within its body and forced out through holes at the rear, provide propulsion for this model of a stratosphere airship built by Charles R. Miner.

A DESIGN for a metal dirigible that would be capable of flights through the stratosphere has been conceived by Charles R. Miner, of San Francisco, Calif., who has constructed a model to demonstrate his theories. The model incorporates unusual methods of creating lifting power and propelling the craft, utilizing currents of air generated within the body of the airship.

A full-sized dirigible built from Miner's design would feature a Diesel engine to operate electric dynamos that would supply power for all apparatus aboard. Steering and propulsion would be accomplished by forcing air through openings at the bottom, rear, and sides of the airship. The force would be generated by huge blowers within the structure and passed through manifolds which would govern the pressure of the air.

Wings Serve As Radiators

A NEW design of airplane cooling equipment, wherein the wings become the radiator for the powerful engines, has been developed by Major Clinton W. Howard of the U. S. Air Corps. Free use of the invention has been granted to the government.

The object of the invention is to eliminate the need for bulky, weighty radiators in planes equipped with water-cooled engines. Not only do such radiators act as dead weight, but they offer great wind resistance, thereby cutting down the efficiency of the aircraft.

The invention is adapted for planes having metallic wings. Without altering the outward shape of the wings, the inventor uses the hollow spaces in the wings and the reinforcing beams and channels to distribute the hot water and steam from the engine.

By a particular arrangement of the beams and channels, not only does he obtain uniform distribution and circulation of the liquid but additional reinforcement of the wing structure is secured. The large wing also means additional cooling surface.

Radio Hooked On Cultivator

A RADIO receiver mounted on a cultivator helps to brighten the day's work for Leonard Carlson, an Akron, Iowa, farmer. In addition to picking up programs of radio entertainment, the receiver is used to tune in broadcasts of farm produce prices and weather reports.

The radio receiver has three tubes and is equipped with headphones attached to a special band to permit wearing of a hat while listening. A single B-battery and two dry cell batteries supply the power.

A battery-operated radio receiver mounted on a cultivator helps to make long hours of field work less tiresome for Leonard Carlson, shown tuning in some radio entertainment.

WORKSHOP HOBBIES

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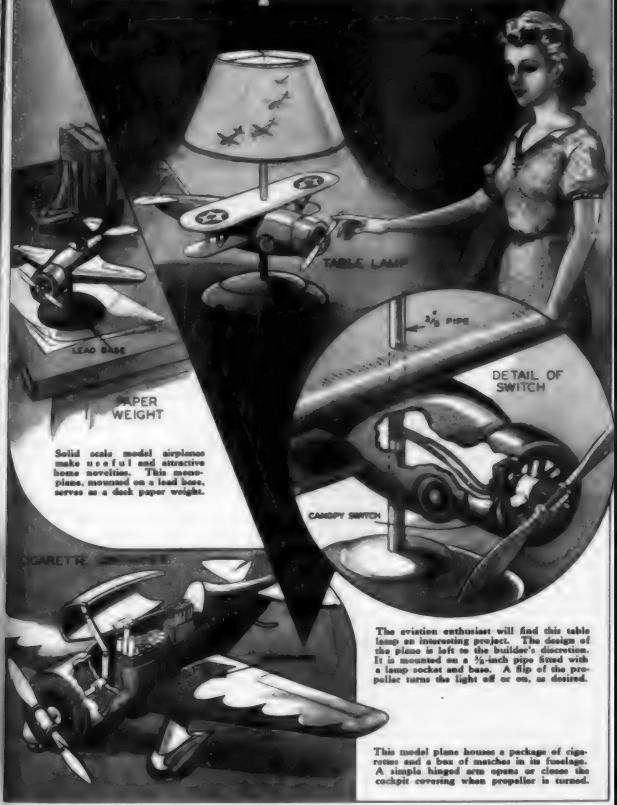
Model Airplane Novelties



Solid scale model airplanes make useful and attractive home novelties. This monoplane, mounted on a lead base, serves as a desk paper weight.

The aviation enthusiast will find this table lamp an interesting project. The design of the plane is left to the builder's discretion. It is mounted on a ½-inch pipe fitted with a lamp socket and base. A flip of the propeller turns the light off or on, as desired.

This model plane houses a package of cigarettes and a box of matches in its fuselage. A simple hinged arm opens or closes the cockpit covering when propeller is turned.

TRICKS WITH

Top—"Take-Away", a simple match game in which you are always the winner. Circle—Forming 2 triangles with 3 matches, and 5 triangles with 9 matches. Above—Making 6 matches form a total of 4 triangles is a really clever stunt.

HERE are several easy tricks you can master in a few minutes and use to surprise and entertain your friends. They are good stunts for parties and when guests drop in for the evening.

Hand some one five matches and ask him to form two triangles with them. Hand to another person, nine matches and ask him if from them he can make five triangles. These two tricks are quite easy as the accompanying illustrations indicate. You make a single triangle with three of the five matches, then form another triangle with the remaining two on the base of the first. The same procedure is followed with the nine match, five triangle trick. To get the fifth triangle you of course, count the large triangle formed by the four smaller ones.

Another even more interesting triangle trick to form four triangles from only six

matches. You first form a triangle from three matches. With the other three you form the other three triangles. A rough surface is best since the smooth top of a table will cause the standing matches to slide. A bit of glue touched to the match heads will cause them to adhere.

Take-Away Matches is a dandy game. It is so perplexing, yet so simple to those who know the rule, that the results are often very amusing. For try as he will, your opponent cannot win until he too knows the rule.

Lay out 15 matches evenly spaced on the table. The object of the game is to make your opponent pick up the last match. One, two or three matches can be removed at a time. The rule or secret is to have 13, 9 and 5 matches remain when it is the opponent's turn to move. Either man can start. If you can work it down in any event so that 5 matches remain when it's your opponent's turn, you will have him beaten. This rule to follow is so subtle that unless your competition knows it, too, you can win every time.

Two matches are required to perform this Magnetic Match trick. Some practice is of course necessary before you too, become proficient. You simply flick the match with the second finger which causes the other match to jump. Interest and mystery will be heightened if you bring the match over some metallic object and work out a bit of patter to go with the trick.

Another simple, but very effective match trick, which anyone can perform, present the optical illusion of one match passing through another. Grasp a match, one in each hand, between the index and forefinger, so that they interlock. By practice, learn to re-

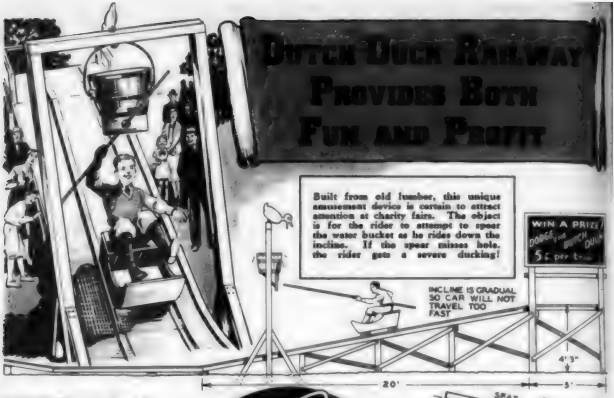
[*Continued on page* 128]

These entertaining stunts will inject new life into any party.

MATCHES

Above—This magic wand, containing soap in one end and sugar in the other, attracts or repels floating matches. Left—How "magnetic" and "pass-through" tricks are performed.

Dutch Duck Railway Provides Both Fun and Profit



THIS "Dutch Duck" railway will prove highly popular, as well as profitable, at amateur fairs. Construction is relatively simple and if old lumber is purchased from a wrecking yard the expense of material for the track will be minimum. It can all be rough lumber with the exception of the rails which should be surfaced for the rollers. Note that the incline is not at all steep so that the car will not be traveling at too great speed when the passenger attempts to spear the hole under the water barrel. With a good eye and steady hand he will escape a ducking, but if he fails to put his lance through the hole he certainly is going to need a towel.

The track can be made shorter if space is limited, and the incline a bit steeper. Of course, the rails should be the same distance apart the entire length and joints fitted neatly.

For the ducking device, it will be more fun to have a generous container than a small one with only a gallon or so of water. A barrel or keg makes a good vessel if cut off about one-third from the top, and fitted with a bail slightly above the center of gravity so that no great effort will be required to tilt it.

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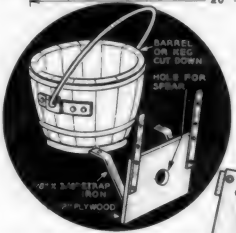
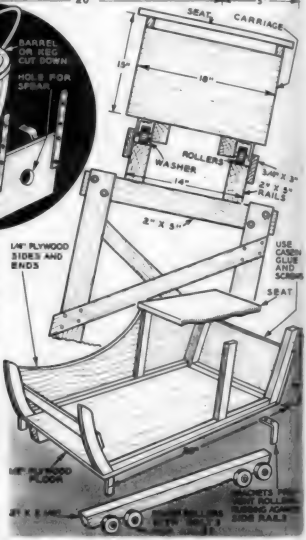
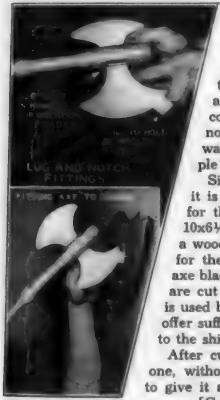




All basic dimensions for the "Dutch Duck Railways" are given in above plans. The coaster car is assembled from plywood. The car rolls on skate wheels, installed in the manner shown.

MODERN DESIGN FOR AN ANCIENT LAMP

In design dating back to the days when Knights were bold, this ancient "Battle-Axe Lamp" provides the craftsman with an interesting one-evening project. Make the axe blades and handle from spruce by following the pattern shown at right. The shield is cut from walnut or mahogany stock. Details of the axe assembly are shown below. A key type socket is fitted to end of handle with a ⅛" pipe nipple and nut. A parchment shade completes lamp.



HARKENING back to the days when the battle-axe could be tossed into a convenient beam, and a torch attached thereon, this electrified "battle-axe" makes an excellent hall lamp and an interesting construction project for craftsmen. While not designed as a reading lamp, the simple wall attachment renders relocation a simple matter.

Since the amount of wood used is small, it is suggested that a rare wood be used for the shield. This is cut from a piece 10x6½x1 inch stock. Round all edges with a wood rasp then drill and slot, as shown, for the electric cord and the lug on the axe blade. The blades are next, and these are cut from ½ inch spruce. This wood is used because it has long fibers and will offer sufficient strength for the connection to the shield.

After cutting out the blades bevel the one, without the lug, on a sanding disc to give it a sharpened appearance. The

[*Continued on page* 130]

How To Clean And

by Lieut. Chas. E. Chapel, U. S. M. C.

A CLEAN, oiled rifle, revolver, or shotgun never rusts. Most shooters would be insulted if accused of not properly brushing their teeth, yet these same men neglect their guns and wonder why they miss the target. To simplify matters, we divide the cleaning process into five easy steps which should be followed at the end of each day's firing.

First, soak a flannel patch in powder solvent and place it on the end of the cleaning rod. Insert the rod and patch in the barrel, from the breech, run the rod forward until the patch comes out of the muzzle, then pull the rod backward until the patch is returned to the breech. This is called "swabbing the bore" and should be repeated several times ten or twelve being correct. If you do not have a cleaning rack, such as those used by gun clubs, it will be convenient to place a piece of clean paper on the floor, rest the muzzle on the paper, and work with the barrel in a vertical position. It is best to work from the breech, but you can clean from the muzzle if you use your fingers to guide the rod so that it does not mar the rifling at the muzzle. One flannel patch is enough at this step of the cleaning process, but throw it away when you are through.

You can make your own powder solvent by mixing equal parts of the best grade Turpentine, pure Sperm Oil, and Acetone. Your neighborhood druggist can mix these together for you, or you can do it yourself; there is no special trick to it, except that you must use a bottle with a glass stopper. Commercial powder solvents contain "alkanet root" which

Condition Your Firearms

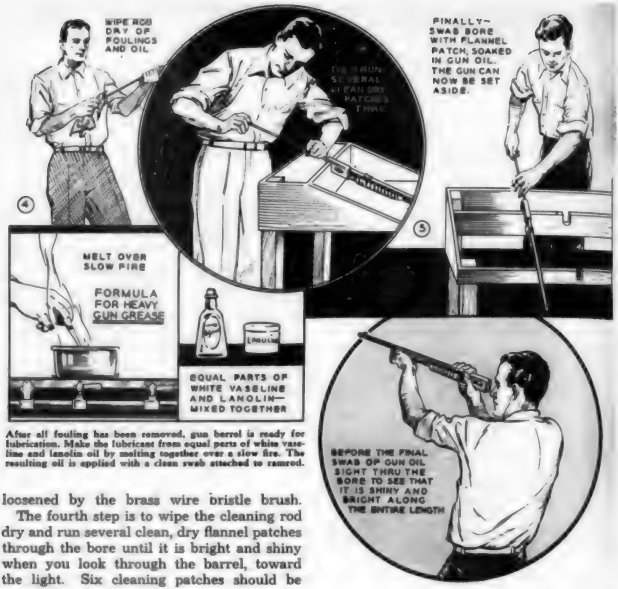
has been soaked in the turpentine before the three ingredients were mixed, but the only purpose of the alkanet root is to give the mixture a red color. It does not add to the effectiveness of the powder solvent. The word "acetone," it must be explained, sounds as though it were a trade name, but it is actually a chemical long known for its powers as a solvent, and for the fast rate of evaporation, hence the glass stopper for the bottle.

The second step in gun cleaning, is to run a brass wire bristle brush, (Tomlinson cleaner for a shotgun), through the bore, working from the breech to the muzzle and back again; three times for a rifle or pistol, more often for a shotgun in case it is badly leaded. This step takes place while the bore is still wet with the powder solvent, and is intended to loosen caked and sticky powder fouling that did not come out in the first step. If you use .22 caliber rim fire rifles, or revolvers with lead bullets, you can safely omit this second step, but a glance through the bore to see if the bulk of fouling is gone is a better test than any rule.

The third step is to put a fresh flannel cleaning patch on the ramrod and swab the bore once more with powder solvent. If you found it possible to omit the second step this is not necessary since this second application of powder solvent is only intended to wash out the powder fouling and lead

The first step in cleaning a gun bore is to make the powder solvent as shown at left. This is applied with a flannel swab attached to the end of a ramrod. Next, a brass bristle brush is pushed back and forth, through the bore, to remove powder fouling. Follow this with second application of powder solvent.

A formula for a gun bore lubricant is given above. It consists of 1 oz. cocoanut oil and 16 oz. pure sperm oil, mixed together over a slow fire. The oils are then poured into a bottle, containing lead filings, and allowed to settle. After a final filtering through filter paper the gun bore lubricant is ready for use.



After all fouling has been removed, gun barrel is ready for lubrication. Make the lubricant from equal parts of white vaseline and lanolin oil by melting together over a slow fire. The resulting oil is applied with a clean swab attached to ramrod.

loosened by the brass wire bristle brush.

The fourth step is to wipe the cleaning rod dry and run several clean, dry flannel patches through the bore until it is bright and shiny when you look through the barrel, toward the light. Six cleaning patches should be enough for this operation.

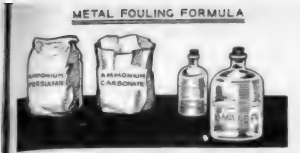
Our fifth and last step is to swab the bore with one flannel patch soaked in gun oil. When you have done this you can safely set your firearm aside for several days, depending on the dampness of the atmosphere. The conservative rule is to run a clean dry patch, followed by an oiled patch through the barrel for ten days after you have finished your season of shooting, and then apply a heavier lubricant if you intend to set your gun aside for storage.

Gun oil can be purchased ready for use, or you can use any light machine oil, but the true gun fan will make his own gun oil by mixing one ounce of pure cocoanut oil with sixteen ounces of pure sperm oil. In cold weather the cocoanut oil will be thick and heavy, and it is necessary to heat the mixture of the two oils until they simmer for about five minutes.

Your mixture of two oils can be "clarified" by adding lead shavings, obtained by scraping or filing a block of pure lead, and then setting the bottle of oil in the sun until the impurities in the oil collect on the lead after which the oil is poured off, and filtered through filtering paper.

Your gun oil protects the bore for short periods, and can be used for the "action" of the breech. Simply wipe off the accessible portions of the breech action to remove dirt and moisture, and then apply a light coat of the gun oil. Too much oil will interfere with the ignition of the cartridge or shell. In the Arctic regions, the cold will congeal gun oil and you must use powdered graphite for a lubricant. The entire metal exterior of the gun should be kept lightly oiled to prevent rust; Arctic cold has no important effect on this use of your gun oil.

Before firing again, swab the bore and chamber with several clean dry patches to

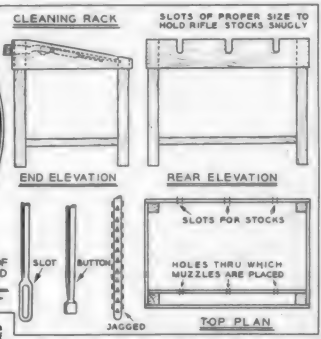


you use "anhydrous lanolin," otherwise a considerable amount of moisture will be present to defeat the purpose of the gun grease.

Carelessness in cleaning, or the wrong ammunition, may give the bore of your gun, metal fouling which appears as spots and streaks of grey in contrast to the shiny surface of the bore when examined against the light. If not removed, metal fouling will reduce the accuracy of your shooting and, in time, rust will develop, under the metal fouling, and ruin the barrel.

Metal Fouling Solution, like all gun preparations, can be purchased ready to use. The amateur should use the commercial product unless he has the patience and interest to correctly compound formulas. The small amount saved in the price of gun preparations

Metal fouling can best be removed by applying the formula made as described at top. Bear in mind that this formula is of no value if the gun is military type using ammunition loaded with potassium chlorate primers. In this event, the gun bore should be washed out with boiling water as shown in circle.



A gun rack is an accessory that will simplify, to a considerable degree, the gun cleaning operation. A practical frame construction plan is illustrated here. Dimensions are not given as they will vary according to types of guns.

remove all oil. Oil in the bore makes the first few shots strike wild of the mark, and it also increases breech pressure. The presence of too much oil or grease may burst the barrel, with serious danger to the life of the shooter.

If you put your gun away for storage, disassemble and put a heavy coat of gun grease on all parts, especially in the bore. Gun grease can be made by melting together, over a slow heat, equal parts by weight of Anhydrous Lanolin, and Pure White Vaseline. Lanolin is simply refined grease obtained from sheep wool, but you must be sure that

is not worth the risk of damage but for those who are real "fans" there is a great deal of fun in knowing that you are able to do things for yourself.

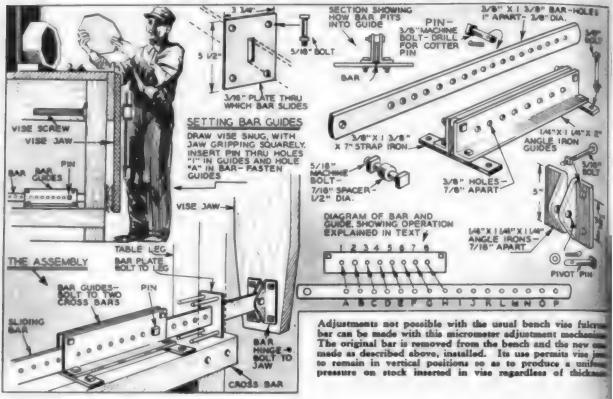
Here is the Metal Fouling formula:

Ammonium Persulfate	.....220 grains
Ammonium Carbonate	....100 grains
Ammonia, (28%)	..... 90 c. c.
Distilled Water	..... 60 c. c.

Mix the first two, which are powders, together and place in a bottle with a rubber

[*Continued on page 124*]

Adjustment Adds Flexibility To Bench Vise



Adjustment not possible with the usual bench vise fulcrum bar can be made with this micrometer adjustment mechanism. The original bar is removed from the bench and the new one made as described above, installed. Its use permits vise jaws to remain in vertical positions so as to produce a uniform pressure on stock inserted in vise regardless of thickness.

THE movable jaw of the average bench vise is operated by means of a hand screw, and the bottom of the jaw is adjustable by means of a bar, at intervals of from 1½ to 2 inches. With such coarse adjustment, however, it is impossible to present a square grip to work of all dimensions.

The construction of an adjustment giving ⅛-inch intervals is clearly explained in the accompanying illustrations. As stock materials are usually furnished in widths and thicknesses measured in multiples of ⅛-inch, such an adjustment is most useful in woodworking.

To operate the adjustment, align hole "A," in the bar, with hole "1," in the guide. The vise jaw will close tight, and square. To use the vise for ⅛-inch work, align holes "B" and "2"; for ¼-inch work, holes "C" and "3"; for ½-inch work, holes "E" and "5", etc. For ⅞-inch work, holes "H" and "8" are aligned, and to work on 1-inch stock, align holes "B" and "1."

Thus, a variation of 1-inch of working space has been accomplished in ⅛-inch intervals. Similarly, for 1½-inch work, align holes "F" and "5"; for 2-inch work, holes "C" and "1"; and for 5-inch work, holes "F" and "1." In this manner, any size work can be handled.

Luminous Paint Easily Made

A LUMINOUS paint that will find many uses in the home workshop can be made from chemicals which your local druggist can supply. The resulting paint can be used for painting numerals on clock dials, keyholes, switchplates and for decorating novelties. The formula consists of the following ingredients:

100 grams, Calcium Carbonate
2 grams, Sodium Carbonate
30 grams, Sulphur
½ gram, Bismuth Nitrate
½ gram, Table Salt

Place the ingredients in a mortar and grind into a powder, then place the resulting mixture in a crucible and heat for one-half hour over a blow torch or bunsen burner. Place a small sheet of asbestos over the crucible so that the sulphur gas does not escape. The crucible must be heated red hot and remain in this condition for the time indicated.

Remove the crucible from the flame and allow it to cool; the chemicals are removed, and once more ground up in the mortar. After exposing for sometime in the sunlight, they are ready to be mixed with a paint base. For best results either clear lacquer or acetate dope should be used. Mix the powder thoroughly through the lacquer. Apply it to articles with small camels hair brush.

AN OLD FASHIONED DOORBELL

by Kenneth Murray

NO DOUBT you have seen, at least in motion pictures, the ancestor of the modern doorbell; it consisted of a small call bell suspended by a loosely-coiled spring and was rung by pulling the end of a long cord. A modern version of this type of bell is described here. It is an unusual novelty and aside from its quaintness it is kind to the ears; no matter how long the push-button is pressed the bell will ring only twice, with a pleasing tinkle that can be heard throughout the house.

The mounting consists of a piece of wood about 3x4¼-inches and a slightly larger piece of thin pressed wood. To the latter, screw the double magnets from an old electric bell or buzzer, and cut a hole in the thicker board so that they can be assembled as shown in the accompanying illustrations. Bend a length of light spring-brass wire to the shape outlined in the assembly plan and then solder a short screw to the small loop so that it can be attached to the mounting. A piece of soft iron is next soldered to the spring that it will rest exactly over the magnets; the old electric bell will supply this part also. Slip a piece of asbestos between the magnets and the iron when soldering. The bell can be purchased at any novelty shop for 10c. Attach the handle firmly to the end of the spring and shorten the clapper so that it will hit at the slightest jolt.

The completed doorbell is pictured at left. Below is shown the manner in which the magnets are mounted to the plywood base. Lower right—When soldering the iron armature to the spring insert a piece of asbestos between it and magnets to protect them from heat.

The bell support is formed from light spring brass wire bent "S" shape. A small iron strip soldered to the wire opposite the bell magnets produces ringing effect.

SCAN THE SKIES with this powerful

by R. DeWitt Miller

The mirror being polished by means of the pitch lap substituted for the glass "tool" used during the rough grinding stage. Rouge mixed with water is the abrasive. As polishing is done according to time, a time chart should be kept. After each half hour of polishing the mirror should be checked. The reading glass test will show surface pits not otherwise visible.

Mirror and equipment set up for the Foucault test, accurate up to one-millionth of an inch. The mirror is at the left and a pin point of light is directed to its surface and back to the eye of the person conducting the test. This is done by moving the pin hole slightly to one side of the mirror's center. By use of a knife edge or razor, part of the light is cut off just before it enters the eye. Depressions in surface of glass show as shadows.

PART II

THE polishing of a telescope mirror technically begins with a pitch "lap" is substituted for a glass disk or "tool." At the same time the carborundum abrasive used in rough and fine grinding is abandoned, optical rouge being substituted.

After the application of 303½ emory, the final stage in fine grinding, the mirror will have been brought within a few inches of the desired focal length. The rough test for focal

In this second installment directions are given for final polishing and silvering the mirror preparatory to placing it in a mounting ready for use.

home-made telescope

lengths was described in the previous article.

Before beginning a description of the polishing operation, it is well to point out the meaning of the term "parabolic," and its significance in mirror grinding.

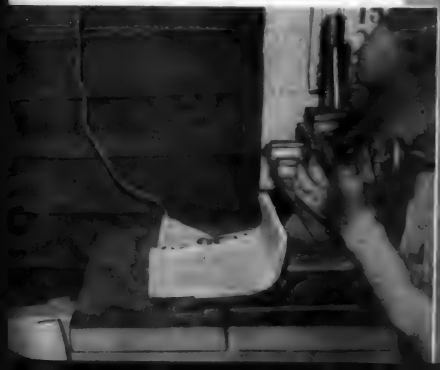
A parabolic mirror is one which, instead of being perfectly spherical, has its center deepened to form a parabolic curve.

The rays of light coming from distant celestial bodies are parallel. A parabolic curve is the only one which will bring parallel light to a sharp focus.

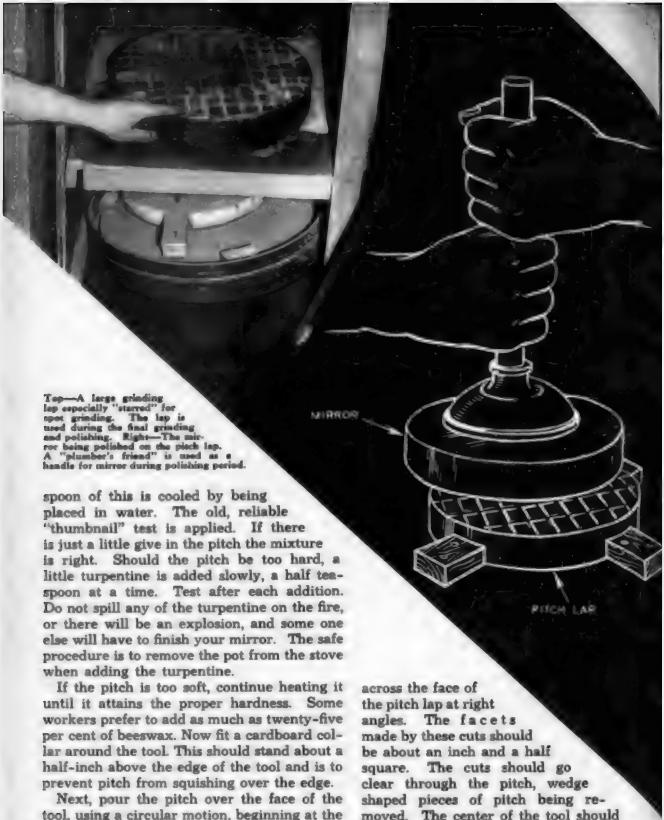
However, a small spherical mirror approaches the parabolic curve so closely that it will work very efficiently. In fact, the technical staff of the Mt. Wilson Observatory advises the amateur attempting the construction of his first telescope to grind a spherical mirror, rather than to attempt a parabolic one.

The machine for mirror grinding, described in the previous article, will also grind a parabolic mirror, should the worker wish to attempt one. To return to the polishing. The first thing to do is to make a pitch lap. This is done in the following manner:

A mixture of pitch and five to ten per cent of beeswax is heated until molten and strained through three layers of cheesecloth. A fab



Above—Instrument for creating a pin point of light used in the Foucault test. This instrument eliminates lamp chimney and uses for light source. In this instrument the light is created by an electric bulb and specially ground lens.



Top—A large grinding lap especially "starred" for spot grinding. The lap is used during the final grinding and polishing. Right—The mirror being polished on the pitch lap. A "plumber's friend" is used as a handle for mirror during polishing period.

spoon of this is cooled by being placed in water. The old, reliable "thumbnail" test is applied. If there is just a little give in the pitch the mixture is right. Should the pitch be too hard, a little turpentine is added slowly, a half teaspoon at a time. Test after each addition. Do not spill any of the turpentine on the fire, or there will be an explosion, and some one else will have to finish your mirror. The safe procedure is to remove the pot from the stove when adding the turpentine.

If the pitch is too soft, continue heating it until it attains the proper hardness. Some workers prefer to add as much as twenty-five per cent of beeswax. Now fit a cardboard collar around the tool. This should stand about a half-inch above the edge of the tool and is to prevent pitch from squishing over the edge.

Next, pour the pitch over the face of the tool, using a circular motion, beginning at the outside and ending in the middle; slightly more pitch is placed in the center. While the pitch is still soft, cover it with a handkerchief which has been dampened. Wash the face of the mirror with soapy water and force it down on top of the pitch, turning it round and round so as to get perfect contact.

Remove the mirror, take the handkerchief off the pitch, and with a sharp knife, cut facets in the face of the pitch.

These facets are formed by making cuts across the face of the pitch lap at right angles. The facets made by these cuts should be about an inch and a half square. The cuts should go clear through the pitch, wedge shaped pieces of pitch being removed. The center of the tool should always be in the corner of a facet.

After the facets are cut, the wet handkerchief is replaced on the pitch, the mirror again sloshed with soapy water, and forced down on the lap. This is to correct any errors in the curve caused by the cutting of the facets.

It is a good plan to allow the mirror to remain on the tool over night under a weight of four or five pounds.

When the lap is finished, you are ready to begin polishing. The strokes given, either by

the machine or by hand, are the same as in grinding. The pitch lap is substituted for the tool, and rouge and is used as the abrasive. The rouge should be mixed with water until it has the consistency of house paint.

As polishing is done by time, you should keep a time chart. After each half hour of polishing, the mirror should be checked.

The reading glass test using an out-of-focus disk of the sun, described in the previous article, is used to check the surface of the mirror for pits.

Besides checking for pits, it is necessary to determine how near the mirror is approaching the desired focal length and whether it is getting out of the true curve. To determine these facts we employ one of the most accurate and beautiful tests in the whole realm of optics. This is the Foucault test, and is accurate up to one-millionth of an inch.

To apply the Foucault test we set the mirror on edge on a bench and direct a pin point of light on its surface. The simplest way to create this pin point of light is by the following method:

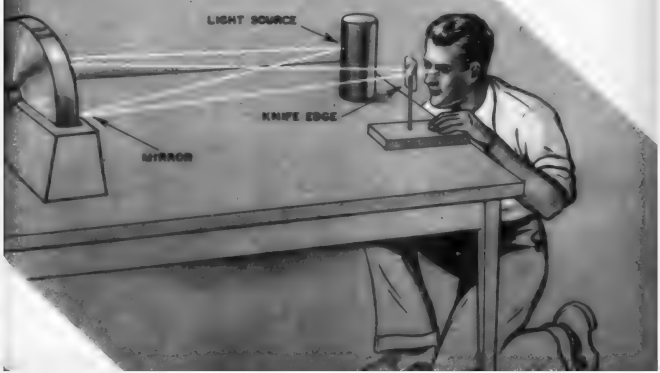
Cover an oil lamp—an electric globe will not do—with an opaque chimney. This chimney takes the form of a cylinder, and is usually made of light metal. A pin hole is punched in the chimney. This may be done by filing or buffing an area of the shade until it is extremely thin, and then driving the point of a needle through it. If the metal is sufficiently thin, it will be easily penetrated. An old zinc dry-cell case will make an ideal shade.

To apply the Foucault test a knife also is required. An old razor blade mounted perpendicularly on a base will do nicely.

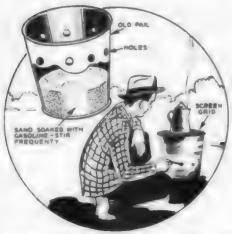
As the scientific explanation of the optical laws on which the Foucault test is based is too long to include in this article, we will merely describe what is actually seen by the worker. An explanation of the test will be found in any standard work on optics. The

[*Continued on page 132*]

Below—
Drawing of the apparatus in operation during the Foucault test. The light source is shown at the right. Beam of light travels to the mirror and then into the eye of the observer. A knife edge is used to cut off part of the rays just before they enter the eye. When the knife edge is moved laterally across the light ray, the eye sees the shadow of the knife moving across the mirror. If the edge cuts the beam within the focus, shadow crosses mirror in same direction as the knife edge, but if it is outside the focus, the direction of movement is reversed.



Handikinks for Outdoor Campers



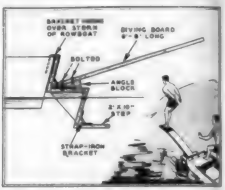
Bucket Makes Handy Camp Grill

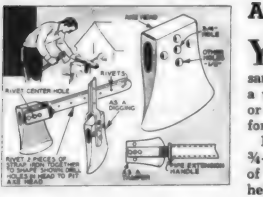
THE week-end camper will find this simple barbecue pit a very useful accessory. Fashioned from an old water pail, its cost is negligible. Around the top of the bucket, punch holes so as to provide the necessary draft. Form a grill from heavy iron wire and place this over the top of the bucket so as to provide a support for camping utensils.

The necessary heat is generated by sand which has been thoroughly saturated with gasoline. The correct amount of fuel can best be determined by experiment.

Diving Board Attaches To Rowboat

WHERE the shore of the summer camp is not adapted for diving, a unique diving board can be made from scrap lumber and attached to the stern of a row boat, the boat being anchored in the deeper water where diving is safe. Make the board as shown in the accompanying illustration from 1-inch planks. Cut four pieces to form the stems and assemble with strap iron brackets. Make the spring board 6 or 8 feet in length and bolt to the top set with angle blocks inserted underneath the plank.





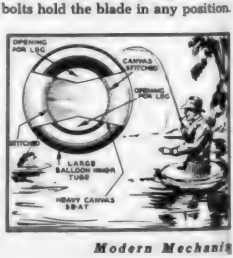
Axe Provided With Folding Handle

YOUR camp axe can be fitted with a folding handle which will not only make it safe to carry, but at the same time add to its value. By adjusting the blade to a vertical position it can be used for digging purposes, or by reversing the blade, the axe head serves as a tamper for pounding down soft dirt.

Remove the original wooden handle and drill four ¾-inch holes as indicated. Make a handle from a length of strap iron and rivet it to the center hole in the axe head. Two machine bolts hold the blade in any position.

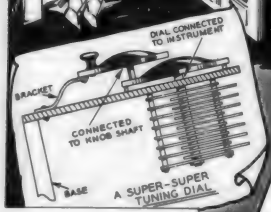
Inner Tube Forms Sportsman's Wader

THE sportsman need not be afraid to step into deep water if he is equipped with this inner tube wader. The wader, itself, is nothing more than a large balloon inner tube fitted with a canvas saddle. Cut the saddle sufficiently large so that it can be lapped over the inner tube and stitched fast. The saddle, it will be noted, is cut in a "V" shape with sufficient space allowed for inserting the legs. Allow the canvas to sag slightly so that it will not produce discomfort when supporting the body. To prevent ripping of canvas, double stitch all edges.

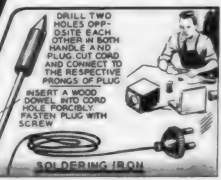


RADIO SPARKS

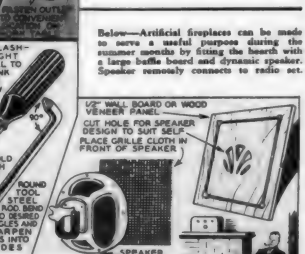
Those who enjoy listening to radio programs during the late evening can do so without disturbing other members of the family by installing a closed circuit jack in series with the voice coil of the dynamic speaker. When earphones are plugged into jack the loud-speaker is automatically silenced.



Super-micrometer adjustment of short wave receivers is possible with this dual dial arrangement. The knob on the original dial is removed and a ¼-inch shaft connected in its place. An additional dial, similar to the original vernier, is attached to the shaft so stations may be "band spread" tuned.



By removing the original cord from the soldering iron and attaching a male fixture plug to the end of the handle, the radio experimenter can convert his iron into a modern "wireless" type. An extension plug mounted on workbench supplies current to iron and also serves as iron stand.



Below—Artificial fireplaces can be made to serve a useful purpose during the summer months by fitting the hearth with a large baffle board and dynamic speaker. Speaker remotely connects to radio set.

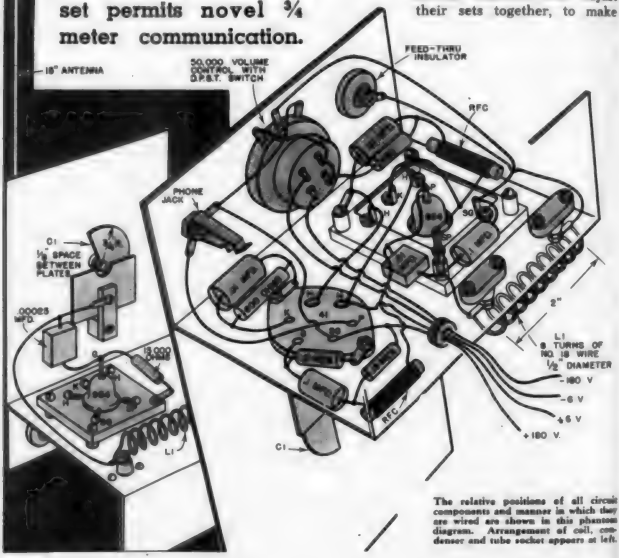
Every experimenter will find these screwdrivers useful in radio repair work. The illuminated tool is excellent for working in dark corners while a ground-down washer permits tightening of small set-screws. Out of the way screws can be reached with an angle screwdriver formed from steel rod.

"Tiny Tot"—Companion

by Bill Bartlett

Used in conjunction with the transmitter described last month this set permits novel ¾ meter communication.

HERE is "Tiny Tot" the perfect running mate for the ¾ meter transmitter described in the August issue of MODERN MECHANIX. With the two, it is possible to conduct "horizon range" chats with a fellow radio amateur owning a similar set. The receiver, like the transmitter, is easily and simply built, requiring only that the diagrams and instructions be followed explicitly for success. It must be borne in mind that a slight vagarity in the dimension of tuning coil or condenser will make it impossible for the receiver to tune-in the signals of the transmitter. For that reason, the two persons who intend to communicate should calibrate and adjust their sets together, to make



The relative positions of all circuit components and manner in which they are wired are shown in this phantom diagram. Arrangement of coil, condenser and tube socket appears at left.

Set To ¾ Meter Transmitter

sure of receiving each other's signals

The front panel of "Tiny Tot" is of electralloy, and measures 6 by 4¾ inches. The sub-panel is of the same stock, 2¾ inches deep, 1½ inches high and 4¾ inches wide.

The sub-panel mounts the socket for the 954 acorn type pentode detector, as well as the six prong wafer socket for the type 41 power amplifier tube. The acorn tube socket is elevated from the chassis with ½-inch stand-off insulators as is the tuning coil.

The front panel is drilled with four holes to take the port dial used to tune the variable condenser. At the bottom, the panel has three holes drilled for the antenna feed-thru insulator, the regeneration control potentiometer and the phone-speaker jack.

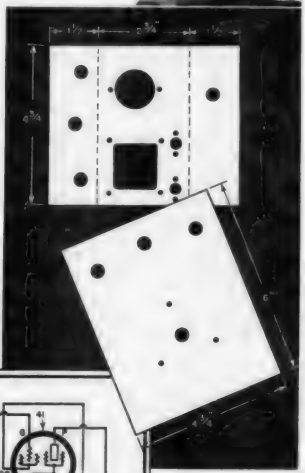
Due to the very low internal capacity of the type 954 acorn tube, the conventional pentode detector circuit is used, regenerating in the same manner as an ordinary receiving tube. Regeneration is smoothly controled by varying the potential on the screen grid of the 954 with a 50,000 ohm potentiometer.

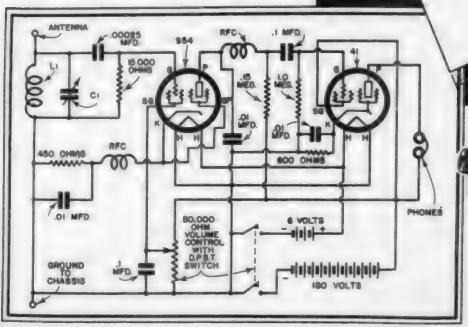
The audio stage utilizes a type 41 automobile tube to provide plenty of push for loudspeaker operation, although headphones may be used in cases where they are more desirable. The audio stage is resistance coupled to abolish fringe howl which is common in regenerative sets.

After mounting all components as explained above and in diagrams and photos, the

[*Continued on page 124*]

Completed, "Tiny Tot" is truly diminutive. Note how it compares in size with pencil.

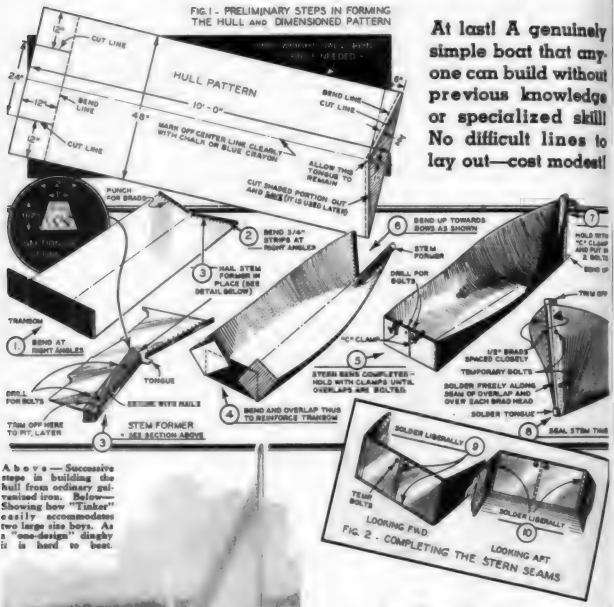




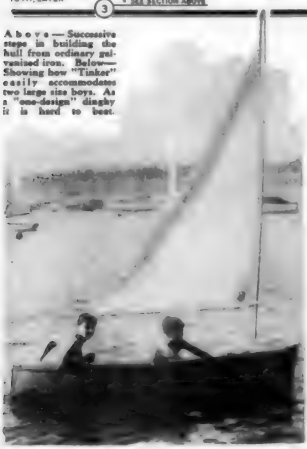
DETAIL OF RFC MAKE 2

At top is shown the template plans form forming the set's metal panel and chassis. Below it is shown the homemade r.f. choke. Left—Schematic circuit.

"TINKER"—A MIDGET



At last! A genuinely simple boat that anyone can build without previous knowledge or specialized skill! No difficult lines to lay out—cost modest!



Above—Successive steps in building the hull from ordinary galvanized iron. **Below**—Showing how "Tinker" easily accommodates two large size boys. As a "one-design" dinghy it is hard to beat.

by Bradley Brewer and Douglas Rolfe

THE word "simple" is so overdone that it is hardly surprising to find the novice inclined to mistrust any job so labelled. In the case of "Tinker" the word is thoroughly justified. Here is the very last thing in simplicity of construction.

Actually, no special boat-building knowledge or experience is required to duplicate this little craft. Though small, "Tinker" is by no means a toy and will serve not only as an excellent general purpose rowboat but also as a neat little one-design sailing dinghy.

There is no careful fitting of planks or tim-

METAL HULL DINGHY

bers to bother about yet, believe it or not, a well-shaped watertight hull results automatically by following the simple plans accompanying this article. Probably the sole requisite for a seaworthy hull is some slight knowledge of soldering. As may be readily seen from the drawings the hull is all-metal. It is formed from a single sheet of galvanized iron, (see Fig. 1 for pattern) which is bent up at one end to form the transom and at the other end to complete the bows or stem. The steps taken to form the metal hull are clearly shown in the detail sketches, Fig. 1.

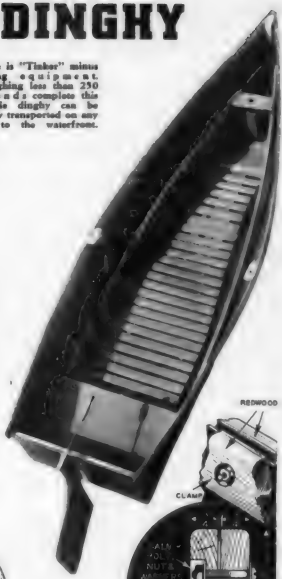
Where the joints occur in the metal they are completed by soldering freely at all seams.

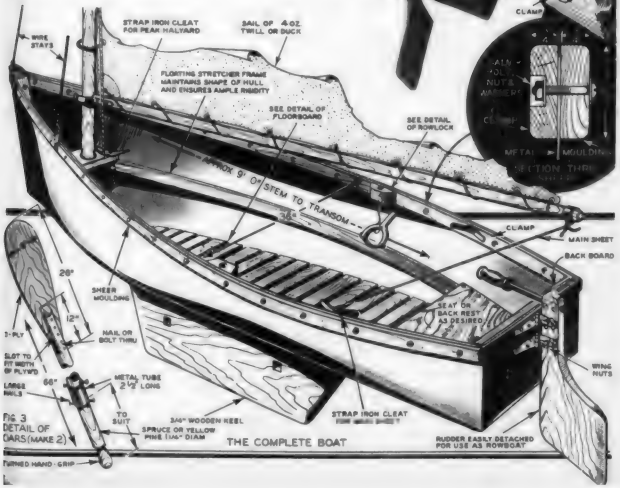
Use ordinary "C" clamps to hold the hull in shape while putting in the temporary holding bolts and soldering the seams. After soldering, test for leaks by putting in a few gallons of water, front and rear, remedying possible leaks. with still more solder.

The entire hull should now be painted, inside and out, with two coats of red lead.

The exterior hull completed, the wooden framing may be undertaken.

Here is "Tinker" minus sailing equipment. Weighing less than 250 pounds complete this simple dinghy can be easily transported on any car to the waterfront.





Of course, as shown in the drawings, the stem former is put in before bending the hull to shape. The remainder of the framing is quite simple. Along each sheer the metal hull is sandwiched between two strips of ¾x2½ inches redwood. Redwood is specified here because of the twist produced by the finished hull line at the sheer. The remaining timbers may be of pine or whatever is handiest.

Bolt the clamp and moulding strips in place as shown, using galvanized bolts and washers in all instances. Take the extra piece of metal left over from the hull pattern and cut out the stem plate which occurs right on the sheer line.

Now cut out the backboard from pine or oak. Notch for clamps and also for the stretcher members (they are both ¾-inch by 2½ inches).

This back-board is later secured in place by the rudder hinge attachment and also by strap iron or angle braces as

Above—"Tinker" sails close into the wind without ocilling! Below—The interior framework of the tin boat.

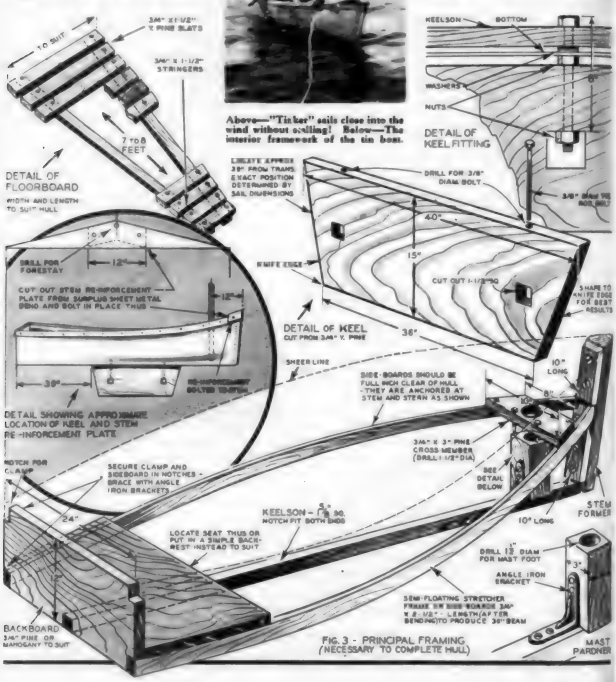


FIG. 3 - PRINCIPAL FRAMING (NECESSARY TO COMPLETE HULL)

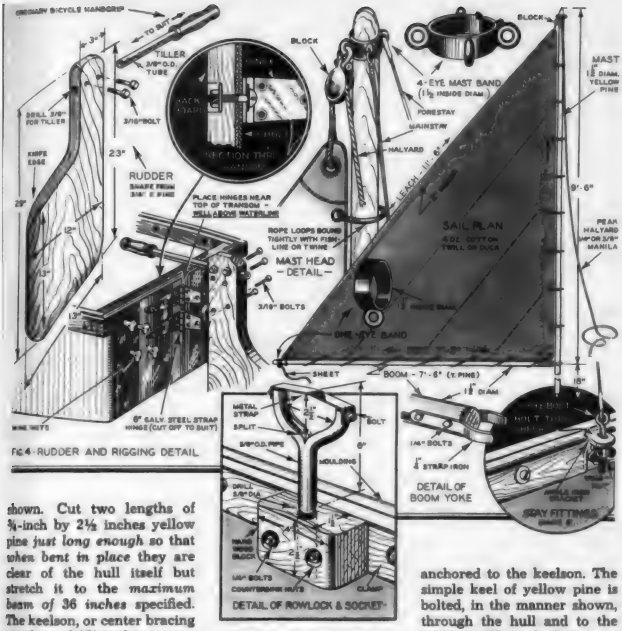


FIG. 4 - RUDDER AND RIGGING DETAIL

shown. Cut two lengths of ¾-inch by 2½ inches yellow pine *just long enough* so that *when bent in place* they are clear of the hull itself but stretch it to the *maximum beam of 36 inches* specified. The keelson, or center bracing member, of 1⅝ inches square material is bent in also at this time. It fits into a notch cut in the back-board and is held at the prow end by two 10-inch strips screwed into the stem former.

A seat may be screwed down to the stretcher frames or a simple back-rest attached with angle irons to the same members. At the bow end, approximately 12 inches from the stem, the mast is stepped into a cross-member which is in turn bolted or screwed to the stretcher frames. The foot of the mast is stepped in a small block anchored to the keelson. The simple keel of yellow pine is bolted, in the manner shown, through the hull and to the keelson. Where the bolts pass through the hull use plenty of red lead to ensure a water-tight joint.

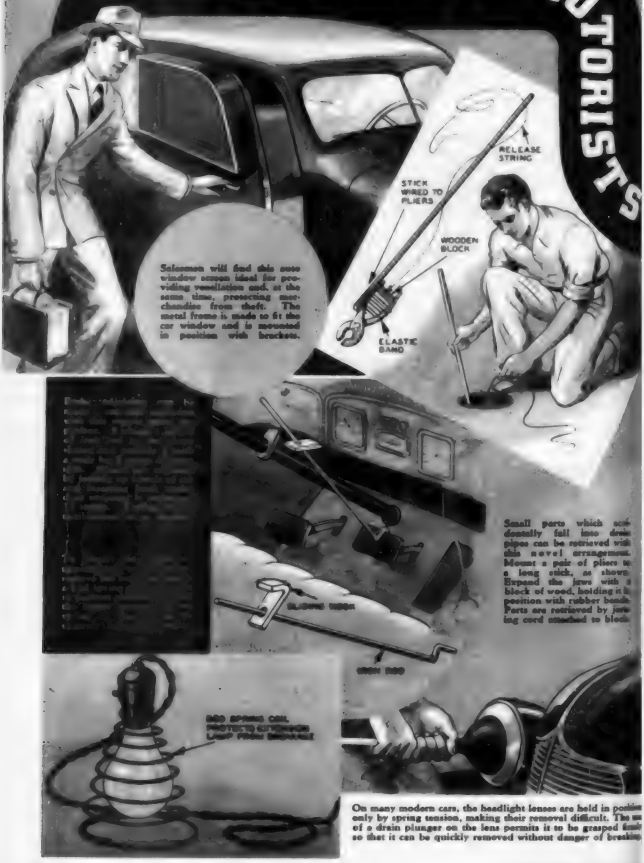
"Tinker" may be rigged to suit your purse. Best boat practice suggests following drawings shown above.

Details of the rudder and the simple rowlocks are adequately covered in the drawings. Note that the rudder is detachable so that it will not impede any rowing activities.

Standard rowlocks may be used if desired. Those shown form a simple substitute for purchased material. Actual rigging details are really up to the builder but following the given plans will not hurt a bit. For the running rigging, ⅜-

[*Continued on page* 128]

TIPS FOR MODERN MOTORISTS



Novel Kinks for Garage and Auto

Auto Crank Case Forms Useful Tool Box

A SIMPLE tool box that will find many applications around the home garage can be made from a crank case salvaged from any car of ancient vintage such as found on all junk lots.

First, clean the crankcase with gasoline so as to free it of all deposits of grease and cylinder oil. To facilitate carrying, attach a handle to the crank case, forming it from a length of cold rolled steel or wrought iron rod. Thread the ends of the rod so that it can be bolted fast through the holes provided in the lip of the case. Completed, the tool rack can be given a coat of rubber-base enamel so as to provide it with an attractive appearance. This enamel is to be preferred, since it has less tendency to chip. The handle can be painted with weather resisting aluminum bronze to give the finished article a neat color contrast.—I. R. Alexander.

Cable Reels For Garage Use

NOTHING is more annoying than stray extension cords lying around the floor of the garage. Cables can be kept in an orderly condition by winding them on reels similar to those shown in the accompanying photograph. They consist of a length of iron water pipe, bent "U shape," and anchored by means of flanges to a wooden base. Spools revolve on an axle inserted in holes drilled in the "U" stand. A box can be built under the base so as to provide a convenient storage space for odd lengths of cable.—Ray Blain.

Snubbers Save Car Bumpers

SNUBBERS for protecting the car's bumper guards can be made from lengths of old bicycle tire, cut to the desired length and slipped over the top of the guards in the manner shown. The lower portion of the tire snubber is split so that it covers the entire guard. One tire will provide sufficient rubber for making four snubbers.—E. Frantz.

Shoe Scraper Fits On Running Board

THE interior of your car can be kept much cleaner by equipping it with a running board shoe scraper. The scraper, made of sheet metal, is attached to the running board under the molding strip. The metal should be of sufficient strength so that it will not bend under continuous use. This little gadget will pay for itself many times over in rural localities where constant cleaning of the car's interior is necessary.—E. Franz.

METAL HUMIDOR COMBINES PIPE RACK

by Dick Hutchinson

AN INTERESTING metalcraft project is this Combination Tobacco Humidor and Pipe Rack. The use of two contrasting metals, aluminum and copper, makes the resulting article worthy of display on any smoking table or office desk. The uniqueness of the humidor is doubled by the brass rings around the top which serve as convenient racks for the smoker's pipes.

The humidor, itself, is formed of No. 18 gauge aluminum, 5½ inches wide by 14½ inches long. Hammer the metal, on one side, with a ball-peen hammer, drill holes for the rivets as shown in the accompanying plans, and roll it into the shape of a drum. From No. 18 gauge sheet copper cut two strips, ¾ inch by 5½ inches and attach one of these over the seam where the drum is joined together. The remaining strip is riveted to the opposite side of the drum to provide the necessary balance. It will be noted that a lip is provided on the ends of the strips so that brass rings, for supporting the pipes, can be attached later.

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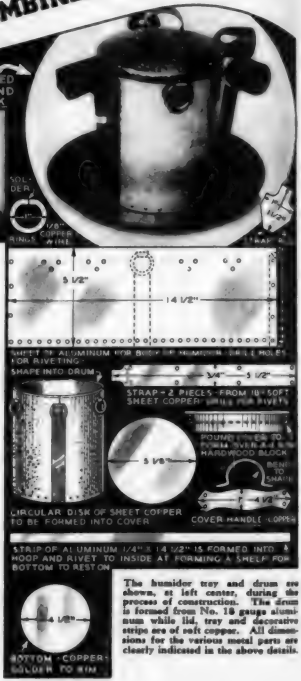
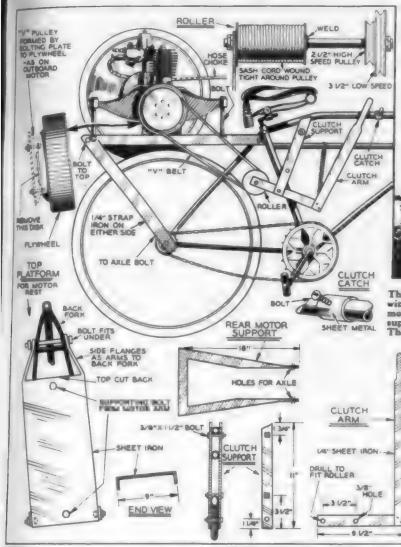


The humidor tray and drum are shown, at left center, during the process of construction. The drum is formed from No. 18 gauge aluminum while lid, tray and decorative strips are of soft copper. All dimensions for the various metal parts are clearly indicated in the above details.

WASHING MACHINE MOTOR POWERS BICYCLE



This practical motorbike may be constructed with excellent results using a washing machine motor. Make motor carrier from galvanized iron supported by a frame made of ¼" strap iron. The clutch arm and support are also cut from this material. A machine bolt serves to hold the clutch arm in place. Set the gas control on the motor until the maximum speed is found. Once set the motor needs no further attention. To stop the bicycle simply throw out the clutch and apply the coaster brake. A two-speed pulley connects from the clutch to motor giving a choice of either high or low speed. In winding the tractive surface on the wheel drive pulley be sure that you wind the rope in the proper direction. Applying shellac to the drum of the pulley before putting on the rope will insure a lasting surface. Besides offering good traction the rope reduces wear on the rear tire. In starting out apply the clutch lever gently and pedal at the same time so as to gradually increase momentum.

IF YOU find it difficult to pull hills with your bicycle why not motorize it? Second-hand gasoline driven wash machine motors can be purchased in many localities for a slight sum and when properly installed make excellent power plants for driving bicycles. The regular luggage carrier rack is substituted with a more durable one made according to the above details.

Mount the motor on the rack using long carriage bolts. A metal plate is bolted on the flywheel to serve as a V pulley. A V belt then connects between the flywheel and the traction pulley. The latter consists of a wide steel bobbin on which has been wound sash cord so as to provide sufficient friction for propelling the bicycle. Attach this pulley to the clutch support and you are ready to ride. Start the bicycle with the regular coaster then pull the clutch arm down to start motor. To stop, release clutch and apply brake.

Bolt Serves As Emergency Tap

IN AN emergency an ordinary steel bolt can be used as a tap when a regulation tap of the correct size is not at hand. With a triangular file make deep clearing grooves on four sides of the bolt. Next, saw off the head and temper. To do this heat the bolt until red hot then cool by submerging in oil. The improvised tap may be used in a brace in the same manner as the usual types although care must be taken in starting the drill so that it cuts straight. Apply a slight pressure to start the tap.

This steel bolt which was filed and tempered made an excellent thread cutting tap for an emergency job.

How to Take Proper Care

by Chester Thomas

Above—Frequent rubbing with a polishing cloth will provide more luster to furniture than periodical waxing. Right—Upholstery can be cleaned with soap jelly, beaten egg white or with carbon tetrachloride.

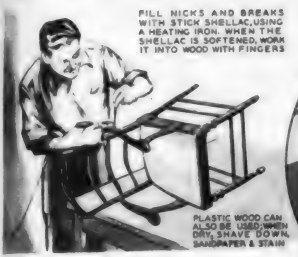
Dry and cracked leather upholstery can be restored to its original soft condition by rubbing neats-foot oil or vaseline into the grain of the leather. Shoe dye will restore faded spots and tears mended by patching on underside with auto tire cement.

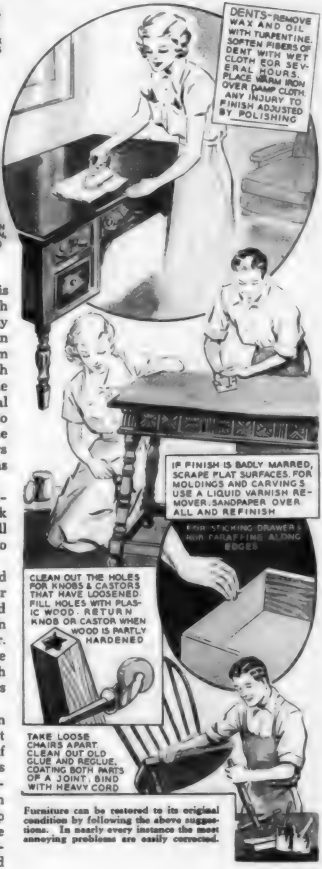
NOTHING detracts more from the appearance of the home interior than scratched or soiled furniture. In most instances these eyesores can be corrected in a few minutes and the furniture restored once more to its original condition. It is not necessary that you be an experienced cabinet maker or upholsterer in order to make a neat repair job. A moderate amount of care in your work will result in workmanship of which you can well be proud.

A glossy finish on furniture is not the result of an excess amount of polish but rather the amount of rubbing it receives. Furniture which has received a single coating of wax over a long period of time will remain beautiful provided it is rubbed constantly with a lint-free polishing cloth.

Where small scratches mar the finish of the wood, they can easily be removed by painting the scratch with turpentine, using a camel's hair brush for the work. Where the scratch is large, the varnish should be removed from the spot with a safety razor and thin coats of varnish applied and left to dry until the scar has been filled up flush with the wood surface. Last, sand the surface smooth with No. 0000 sandpaper and polish with rotten stone and machine oil.

Of Your Home Furniture





Where the entire finish of the furniture is in bad condition, remove all of it with varnish remover, sand the surface smooth and apply a new finish. Dents in furniture can be often removed by swelling. Remove all wax from the spot where the wood is dented with turpentine then apply a damp cloth to the surface, allowing it to remain there for several hours. After the wood has been allowed to soften apply a warm iron, not hot, on the cloth. The heat will expand the wood fibers to their original shape. After the wood has dried out polish the spot.

Where pieces are broken out in the furniture's surface they can be filled in with stick shellac melted with a soldering iron. All paint dealers carry this shellac in colors to match any finish.

Leather upholstery that has dried out and cracked can be made pliable with vaseline or neats-foot oil. Where the leather has faded or shows spots, shoe dye may be applied in a color that will match the rest of the leather. Other minor furniture repairs, such as loose castors and chair legs can be repaired with glue and synthetic wood. Sticking drawers can be eliminated by rubbing with wax.

Repairing home furniture that has been considered worthless is not only fun, but money saving practice as well. The cost of materials for making the necessary repairs is in nearly every instance slight. The suggestions given here show how the more common problems can be solved in the home workshop and with more advanced repair work the knowledge gained here will prove most valuable. For best results good quality paints and varnish should be used in refinishing.

Furniture can be restored to its original condition by following the above suggestions. In nearly every instance the most annoying problems are easily corrected.

Visit New Worlds with

by
Julian D. Corrington

PART I

DO YOU ever longingly read the travel ads and wish you could go on one of those marvelous world cruises? Of course you do—everybody does! But the great majority of us have to take our tours second-hand and by day dreaming.

There are a number of regions, however, to which not even the costliest and most elaborate globe-trotting voyages could take us—realms which can be unlocked only by the possession of a very wonderful yet inexpensive instrument—the microscope. He who owns one of these modern magic carpets has an unlimited series of excursions ready and waiting at a turn of the hand: expeditions undreamed of by the highest intellects of ancient Greece or Rome; in fact, such trips would have been utterly incomprehensible to even the most learned minds of those days.

How does one equip himself to make these journeys? First, he buys a microscope. You can readily find an instrument among the dozens of advertised makes and models to suit your particular needs and purse, ranging all the way from a miniature stand at around $14.00 to a professional type selling between $80.00 and $150.00 according to amount and perfection of optical equipment.

The main points to bear in mind are these: if the microscope is made by a recognized manufacturer who advertises his products nationally and has a reputation to sustain, it will be fully worth the price asked; you will get value received. Naturally, $80.00 will buy a better instrument than will $18.00, but the so-called miniature models of the better brands are not toys in any sense. They are perfectly made microscopes and fully as useful for ordinary purposes as larger stands; their small size permits a saving in manufacturing that is reflected in lower cost. Cheap, imported appliances, and especially anything selling at under $10.00, are to be regarded with suspicion. Most of them are worthless. There is a minimum below which one cannot go if he expects an instrument worthy of the name microscope.

After learning the simple procedure of operating a microscope,

Top—This pestiferous brute drives away the dull moments in a hog's life. This is a photomicrograph of a hog louse. Left—Devil mask of a summer time tormentor—the head of a mosquito as seen under a microscope. Right—How a section of a person's scalp looks under the lens. Notice the great thickness of the hair shafts.

a Home MICROSCOPE

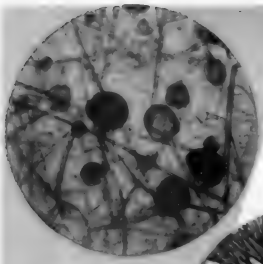
haps the first and most enjoyable journey is the never-to-be-forgotten descent into the freshwater microcosm—that invisible world of life which lies all around us and yet whose presence is not even suspected by the person who has never peered through the lenses of a microscope.

In a drop of pond water one sees teeming

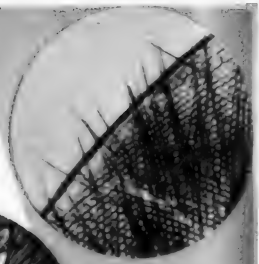
Left—Students of Brooklyn Technical High School using professional type photomicrographic camera. Below—The microscope in industry. Technicians in a modern laboratory inspect food products for impurities or adulterants. Note the small lamp used for illumination.

most of the fun comes in making your own slides. The outfit for this purpose consists of blank glass slides and thin cover-glasses, the latter to be placed on top of the object to be examined; a few chemicals for preserving plant and animal parts, for staining, for rendering transparent, and for mounting; a few tools, as scissors, forceps and needles; a few items of glassware, as dishes and tumblers. This part of the kit can be made as simple or as elaborate as one desires and can be acquired gradually and enlarged from time to time. One such complete assembly, ready for use in a portable case which serves as a laboratory table, costs only $9.50, without a microscope.

Once equipped, whither does one go? Per-



Above—This tangled forest of fruits grew on a moldered piece of bread. A simple fungus, bread mold, under magnification. Use of microscope, even by the beginner, opens a view of everyday things hidden from the naked eye.



Above—The eye of a housefly has a thousand facets and a covering of hair to keep off the pollen. Left—Magnified view of caffeine crystals, the thing that puts the punch in the morning cup of coffee.

life—plant life and animal life and even some forms that are so simple that they are neither plant nor animal, but more elementary than either. Bacteria—many of them relatively very large and most of them harmless to human health; algae—the one-celled or lowly organized water plants; fungi—the water molds which attack living as well as dead animals; protozoa—the one-celled animals such as amoeba and paramecium; tiny polyps and worms; rotifers—those amazingly complex yet so minute "wheel" animals; microcrustacea—the miniature relatives of the shrimp and lobster which one uses as food for the tropical fish of aquaria. Exciting life—motion, plenty of it; warfare—the never-ending struggle to eat but not to be eaten; reproduction and the cycles of individual life, as well as those of whole races and dynasties—these are some of the amazing sights of a tour through the microcosm.

The minute anatomy of higher plants and animals constitutes another safari of great interest. The cells that make up the tissues and organs of the body; digestive cells and nerve cells, blood cells and muscle cells; plant fibers and vessels; chromosomes, those immortal bearers of the hereditary qualities that come down from parent to offspring in each succeeding generation; products of the body, such as crystals, fibers and secretions—there is an almost endless source of materials in this anatomical cruise.

In the kingdom of little life, halfway between the microcosm of invisible beings and that greater sphere of big animals and plants—the macrocosm—of which we ourselves form a part, there are numberless insects, spiders, ticks, worms and the fruits and seeds of plants to investigate. Both free-living and parasitic forms of worms and insects provide sources for many profitable and enjoyable hours spent on one of the greatest hobby horses—the microscope.

Leaving the world of organic beings, one embarks upon a voyage into the inorganic empire of minerals, with their derivative rocks and soils, where the microscope is essential to an understanding of the units of construction—crystals. Here one sees beauty of form and color in every conceivable degree: color running riot, the majesty of mathematical symmetry attaining an amazing perfection. Look at this specimen of azurite under the low power of your instrument with reflected light; ever see anything more spectacular? Observe this matted feltwork of asbestos

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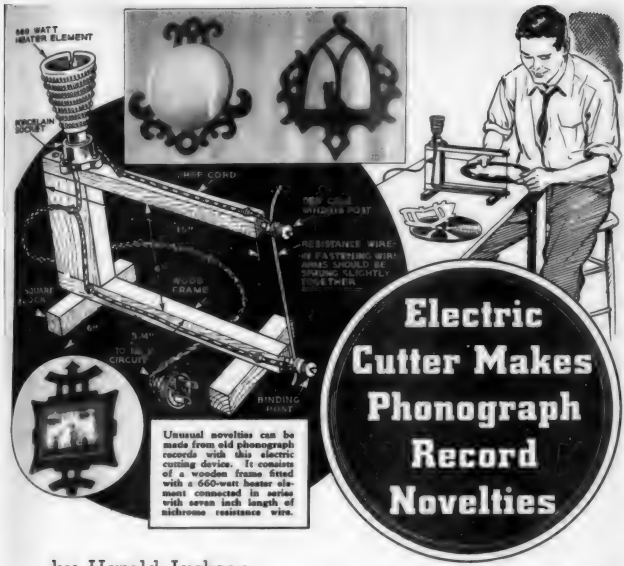


Unusual novelties can be made from old phonograph records with this electric cutting device. It consists of a wooden frame fitted with a 660-watt heater element connected in series with seven inch length of nichrome resistance wire.

Electric Cutter Makes Phonograph Record Novelties

by Harold Jackson

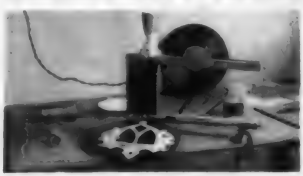
OLD phonograph records that are worn out or have been played so much that they have lost their entertainment value can be found around any home or can be bought in second-hand stores for a few cents each. These old records can be made into very attractive articles by the method described here. Single face records are best for this purpose for they have one smooth side which is used for the front of the finished article.

As phonograph records are made of a composition material they are very difficult to work with ordinary tools. A jig saw is not satisfactory because the teeth are completely worn off the blades with a few inches of cutting, and the heat generated by the friction of the blade melts the composition into a dough which fills in the cut behind the blade.

The use of this electric cutter will prove very satisfactory for this work. It consists of a simple wood frame made to the dimensions shown and wired as indicated. A binding post from the top of a dry cell is driven into the end of each arm to serve as binding posts for the resistance wire, while a porcelain socket is mounted to the top of the frame near the back. This socket carries a 660-watt heating element, which passes

[*Continued on page* 136]

The record cutter can be attached to the workbench, as shown, with a "C" clamp to hold it steady. The heat produced by the wire cutter permits records to be cut into intricate designs.



New and Timely Handikinks

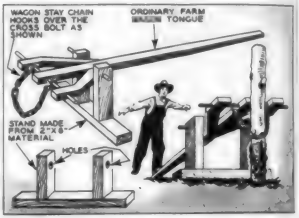
Hook Improves Tin Snips Efficiency

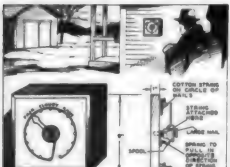
WHEN cutting thick pieces of metal or stiff wire difficulties of having the metal bend are, very often, encountered. To eliminate this, attach a metal hook to the fulcrum bolt of the tins snips to serve as a cutting support.

Make the supporting hook from a piece of thin sheet steel to the approximate size and shape shown. Metal from the blade of an old cross-cut saw is excellent for the purpose. Before the metal can be cut and drilled it must be softened by heating until dull red.—A. Waychoff

Wagon Tongue Pulls Posts

A HEAVY wagon tongue can be used to advantage when a regular post puller is not available, simply by providing it with a suitable fulcrum so that the necessary leverage can be obtained. To use the puller, wrap a length of wagon stay chain around the post and anchor it to the wagon tongue cross bolt. Slip the fulcrum underneath the tongue and apply sufficient force to raise post.





Barometer Made From Odd Parts

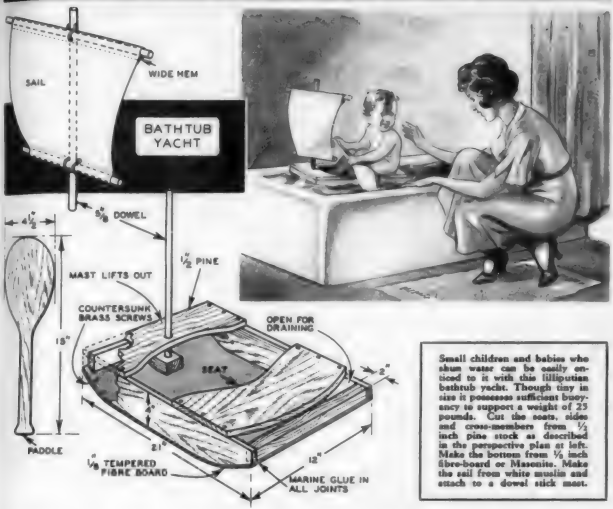
THIS accurate weather indicator costs nothing to build and provides fairly accurate results. It consists of nothing more than a spool knob and pointed to which is attached a length of cotton cord; the cord in turn passing over 16 small nails mounted at 1-inch intervals and anchored to the last one. Expansion and contraction of cord regulates movement of indication. Calibration is determined by experiment. — Frank Shore.

Lubricant Lengthens Model Flights

THE length of model plane flights can be greatly increased by lubricating the rubber band motor with a lubricant consisting of 3 parts, liquid green soap, and 1 part, glycerine, thoroughly mixed and then stored in a bottle for future use.

The lubricant is applied to the rubber band motor with a camels hair artist's brush before setting the plane into flight. Apply it sparingly so that it does not splash the interior of the plane's fuselage. Spare motors can be given added life by soaking them in the lubricant and then storing in metal containers.—L. J. Markus.

Build This Bath Yacht For Baby



Small children and babies who shun water can be easily enticed to it with this lilliputian bathtub yacht. Though tiny in size it possesses sufficient buoyancy to support a weight of 25 pounds. Cut the seats, sides and cross-members from ½ inch pine stock as described in the perspective plan at left. Make the bottom from ⅛ inch fibre-board or Masonite. Make the sail from white muslin and attach to a dowel stick mast.

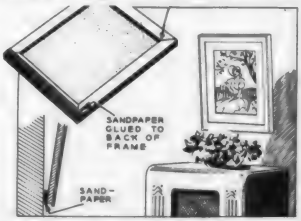
THIS little bath yacht will keep any baby amused as long as he is allowed to play in it, and will start him on an early career of a seaman.

The dimensions of the craft are such, that the yacht will float in a smaller-than-average bathtub and support, with ease, a child weighing up to 25 pounds. The bottom of the boat is made from a single piece of hard fibreboard or Masonite, ⅛-inch thick. Marine glue is used for securing all joints, while the bottom is fastened down with small flathead brass screws, countersunk so as not to scratch the occupant.

Half-inch pine or spruce is used for the sides and seats. The cross-members at the ends are also cut from this stock. The mast is arranged to lift out so that the yacht can be easily stored when not in use. Form the sail from muslin allowing wide seams for the dowel stick spars to slide through.

Non-Slip Wall Pictures

WALL pictures which have a tendency to hang crooked can be corrected of this difficulty by gluing a strip of rather coarse sandpaper along the lower edge of the frame.



Wall pictures which have a tendency to slip out of position can be corrected by attaching a strip of sandpaper as shown.

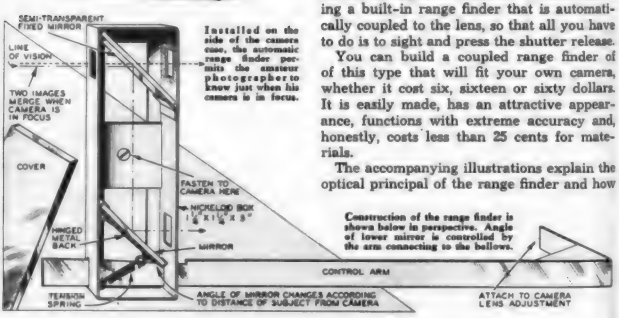
A RANGE FINDER For Automatic

by Kenneth Murray

IF YOU would like to always be sure of taking pictures having that *crisp* sharpness which is so often seen in the work of newspaper photographers, the logical answer is to use a good range finder. It will tell you the exact distance between camera and subject. On the other hand, you could purchase one of the expensive miniature cameras having a built-in range finder that is automatically coupled to the lens, so that all you have to do is to sight and press the shutter release.

You can build a coupled range finder of this type that will fit your own camera, whether it cost six, sixteen or sixty dollars. It is easily made, has an attractive appearance, functions with extreme accuracy and, honestly, costs less than 25 cents for materials.

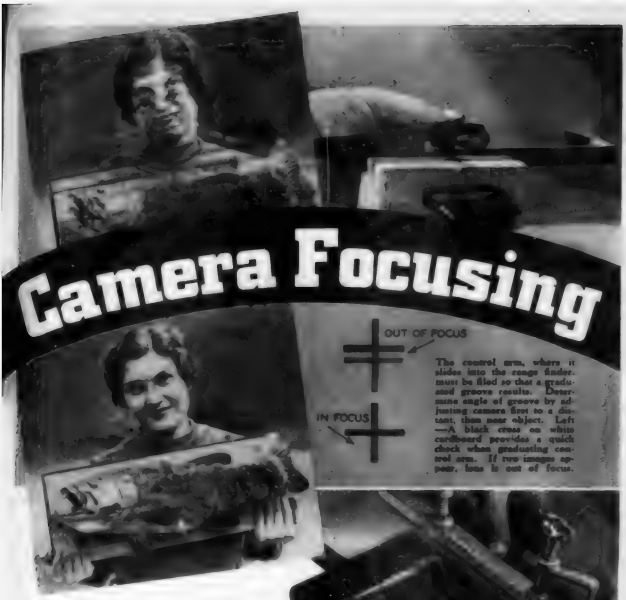
The accompanying illustrations explain the optical principal of the range finder and how



Installed on the side of the camera case, the automatic range finder permits the amateur photographer to know just when his camera is in focus.

Construction of the range finder is shown below in perspective. Angle of lower mirror is controlled by the arm connecting to the bellows.

Camera Focusing



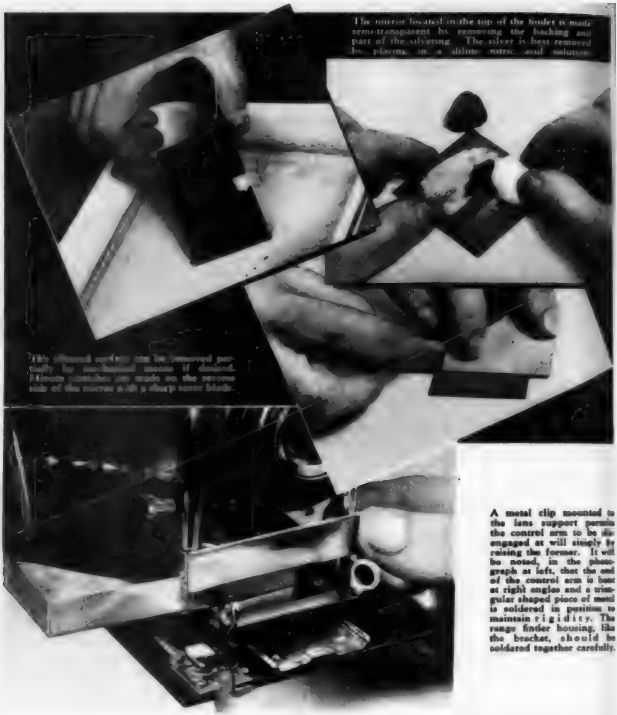
The control arm, where it slides into the range finder, must be filed so that a graduated groove results. Determine angle of groove by adjusting camera first to a distant, then near object. Left —A black cross on white cardboard provides a quick check when graduating control arm. If two images appear, lens is out of focus.

Out of focus, two images will be seen through the range finder as illustrated in photo at top. When the camera bellows is in correct position one image will appear as in the lower photo.

The range finder housing is formed from Nickeloid metal. A pair of "C" clamps and strips of oak provide an excellent means for bending the metal to shape. Lower corner is mounted in a hinged ebo. The control bar, passing under it, regulates angle

it is constructed. Two small mirrors, one of them semi-transparent and the other attached to a hinged bracket so that it may be tilted, are set in opposite ends of a small metal box. You can look directly through the transparent mirror and see the subject or scene to be photographed, but at the same time you will also see the same view, from a different position, reflected from the other mirror. You will thus see a double image; however, they can be caused to come together or merge by merely changing the angle of the second or reflecting mirror.

Only a very slight movement is necessary, the amount depending entirely on the *distance of the subject from the camera.* The movement is secured by means of a coupling to the camera lens mounting. Various types of cam and lever arrangements have been



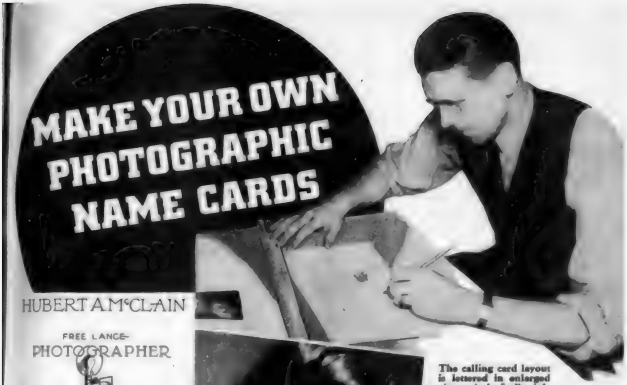
proposed and are used with range finders built into expensive cameras, but you will find the least complicated to be that worked out here. Simple, reliable and positively accurate, the finder serves to graduate the width of the end of the coupling or control arm on which the edge of the second mirror rests. Focusing is possible from infinity (distance) to any closeup that the capacity of the camera bellows will accommodate.

An outstanding advantage is that additional control arms can be made for use when a portrait or telephoto attachment is slipped over the regular lens, focusing then being just as automatic as before.

Nickeloid was chosen for making the box or housing because it is inexpensive, easily bent to shape, solders well and has a presentable appearance without further finishing. The housing measures 1¼ inches square and 5 inches long, making it suitable for cameras of up to 5x7 inches. If you wish to use the device on a miniature camera you can reduce the measurements as much as necessary, but in any case set the mirrors as far apart as

[*Continued on page* 134]

MAKE YOUR OWN PHOTOGRAPHIC NAME CARDS



The illustrated matter for the photographic calling card is hand lettered. It can be any size so long as it is in proportion to photo.

The calling card layout is lettered in enlarged size with India ink.

A photograph of interest is pasted on the layout after which the layout is photographed as shown at left.

BUSINESS cards of a novel and distinctive nature can be made by the amateur photographer with the use of ordinary materials. Originally designed by a Missouri picture shooter for use in his own business, they attracted such favorable comment that he has built up a profitable sideline in producing them for salesmen and shopkeepers. One of the chief advantages of a photographic business car is that it is prized by the recipient and displayed in a prominent place on his desk instead of being thrown away.

The procedure for making photographic cards is simple. They can be any size so long as the lettering is in proportion to the illustration. The layout of the card shown in the accompanying photographs is five times larger than the finished card. The person's name and address is first hand-lettered on drawing board and the snapshot mounted in the relative position in which it is to appear on the finished product. The whole layout is

[*Continued on page* 128]

Here is the finished calling card; one which is certain to attract attention through its very original makeup. Prints should be made on a satin or matte finish paper for best effect.

Aids for Amateur Photographers

New Use For Old 'Squeegees'

SQUEEGEE plates, which have become too dull for further use, can be converted into serviceable developing trays for processing large prints. Bend up the sides and ends of the plates so that the tray attains a depth of about 1½ inches. Do not cut the corners of the metal, but rather fold them over to form a flat-type waterproof joint.—Paul Hadley.

Non-Slip Base For Tripods

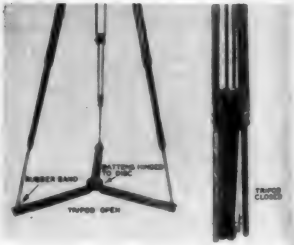
CAMERA tripods which have a tendency to slip when set up on smooth surfaces can be provided with a non-slip base which will permanently eliminate this annoyance. The base consists of nothing more than three wood battens hinged to a round wood disc. Slots cut in the ends of the battens allow for the insertion of the tripod legs which are anchored in place with stout rubber bands. These pass through holes drilled in the tripod legs and are slipped over small screws mounted on opposite sides of the slots.—Fred Dole.

Iron Speeds Print Drying

GLOSSY prints can be dried in a hurry by ironing them with an electric iron. Place the print, face down, on the squeegee plate, in the usual manner, and apply the iron lightly to the back of the print. Exercise caution in heating the iron only partially so that the danger of scorching the prints is eliminated.

Economical Borderless Prints

BORDERLESS enlargements can be made without encountering any waste of paper by mounting the bromide paper to the enlarging easel with glass "push-pins." Push the pins into position at the very edge of the paper, at an angle that will result in their shadow being cast off the paper.—Alfred Dolid.



12 PICTURES ON 3-A FILM

by Dr. C. W. Clifford

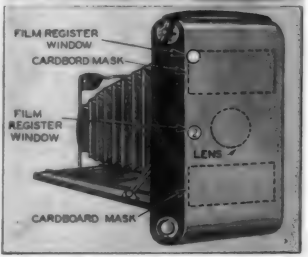
IT IS comparatively a simple operation to double the number of exposures on a 3-A roll film camera. This camera, which ordinarily takes 3¼x5¼-inch postcard size snapshots, can be converted so as to take 12 photos, each measuring 2¾x3¼ inches.

To change the 3-A camera over, it is first necessary to make a new red index window. This should be located 2¾ inches from the bottom of the original window. Do not measure from the center of the window. After locating the proper position of the hole, place two blocks of wood, one on each side of the camera case, and drill a hole ⅜-inch in diameter. The wooden blocks will insure the hole in the case being cut clean.

Insert an additional red celluloid or cellophane window over the new hole by splitting the leather on the back of the camera case and slipping the window under it and cementing in position.

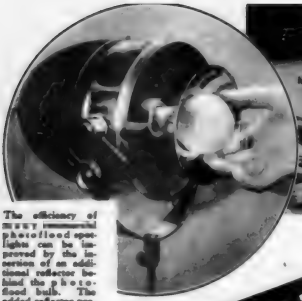
Last of all, make the film masks so as to reduce the size of the 3-A exposures to 2¾x3¾ inches. Very thin pieces of cardboard, which have been painted black on one side with shoe dye, are cut to 2¼ by 3¾ inches in size. Bend over, at right angles, ¼-inch along the

[*Continued on page* 130]



Cardboard masks, inserted in the camera as shown, permit 12 snapshots to be taken on a 6-exposure roll. The phantom diagram shows the camera with added index window and masks.

IMPROVE YOUR PICTURES WITH THESE TESTED PHOTO KINKS

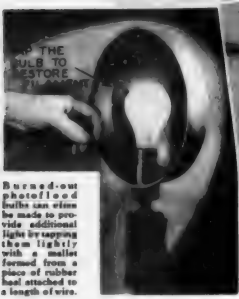


The efficiency of many commercial photoflood spotlights can be improved by the insertion of an additional reflector behind the photoflood bulb. The added reflector provides ½ more light.

The reflector homemade or purchased from an electric shop, is fitted with a metal clip to permit its being attached to the lamp socket. Solder the clip securely to the reflector as shown in the photo at left.

When taking pictures against the light the use of a lens shade, similar to the one pictured here, is most helpful in obtaining excellent results.

Form the lens shade supports from stiff brass wire, bent as shown above. The shade is cut from black velvet and cemented to the frame.



Burned-out photoflood bulbs can often be made to provide additional light by tapping them lightly with a mallet formed from a piece of rubber hose attached to a length of wire.

Undesirable backgrounds can be removed from photographs so as to provide a totally black background by trimming away unwanted portions of the negative with scissors. To make the print, place the negative in printing frame and expose for the usual time. Resulting print is shown above.

Inventors in the News

A National Inventors' Congress held in N. Y. City featured exhibits ranging in size from pins to submarines. Left—A machine that bakes a waffle around a "hot dog" in two minutes.

An adjustable handle, parts that are detachable, and dual sliding blades are features of the compact, light weight grass trimmer invented by John H. Hasler (left). A self-navigating submarine diving device (above), operated by one man, is the invention of Emil Kulik, of Brooklyn, New York. Note controllable arms.

To prove the merit of her idea for a rotary yarn winding machine, Kathryn M. Coburn (above), of Albany, N. Y., constructed a working model from a Meccano set. Commercial adaptation is shown at inventor's left. Circle—A key guard device that also makes a keyhole "peepless" attracted visitors.

Science Builds Telescope

[*Continued from page 49*]

be moved by rail at all. It would also be next to impossible to move such a disc from any ocean harbor in California to the summit of Palomar. Such considerations, however, would be only a few of the minor engineering problems that will be encountered if man ever attempts the construction of a 300-inch telescope. There would be many other greater difficulties.

Another factor that tended to discourage the attempted building of the proposed 300-inch telescope was that astronomers themselves feared the consequences to their own beloved science from the possible successful completion of such an instrument. They estimate that the field of research to be opened up by the thousand million light year range of the 200-inch telescope cannot be exhausted in less than half a century. The 300-inch telescope, assuming that it might have been built, might work to the detriment of astronomy by hurling it into confusion instead of advancing the science by orderly progression.

The astronomers of Caltech and the Carnegie Institute who will have full cooperative use of the 200-inch telescope hold out no hope that the instrument will tell us anything more than we now know concerning plant and animal life that may or may not exist on the other planets. But in the course of time they do expect it to give us the answers to many questions that have puzzled mankind for centuries. It may tell us what our world is, why we are here and where we are going as passengers on this little astral sphere whirling around through unfathomed space. It may tell us whether our universe is exploding, is disintegrating by the dissipation of heat or is being replenished from sources unknown. It may prove or disprove the much-debated theory of Professor Albert Einstein to tell us whether we're living in a "rubber universe" expanding like a toy balloon under pressure from within—a universe imprisoned behind curved walls or a creation that merely goes floating around through space which is without time, without a beginning, and without an end!

Research stimulated by the undertaking has already advanced astronomical technique by fully half a century—even six to eight years in advance of the monster telescope being trained into the heavens. Industrialists and inventors, anxious to have a part in this stupendous endeavor, have developed improved lenses, new photographic emulsions, new metals, new alloys and many previously unknown mechanical processes. It has produced a new process for aluminizing mirrors, which will be used for the first time in the Palomar instrument, taking the place of quicksilver used in the Mount Wilson observatory and in other reflecting telescopes. The new shops at Caltech are now literally crammed with instrumental improvements, specialized machines, and tools born of new necessity.

In selecting Palomar as the site for the 200-inch telescope in preference to hundreds of others investigated in every part of the world, countless factors bearing upon the success of astronomy had to be taken into consideration. Such things as climate, clarity of atmosphere, freedom from aurora borealis and many others, are of tremendous importance. One of the chief reasons for the final choice of Palomar, however, was to avoid the mistake that was made some years ago when the 100-inch Hooker instrument was located on the summit of Mount Wilson.

Artificial light in the atmosphere is as much the enemy of astronomers as it is of a photographer working in the dark room. Go to the summit of Mount Wilson any clear night during the dark of the moon and you will soon see why many of the results anticipated for the 100-inch telescope have failed to materialize. You will look down upon one of the most spectacular displays of artificial light to be seen anywhere in the world—the lights of Los Angeles, Pasadena, Long Beach and scores of other cities stretching away like a carpet of diamonds from the mountains to the sea. Countless tourists go to the top of Mount Wilson every year just to see southern California looking like an inverted heaven with all the stars of the universe assembled into a vast panorama. It's a magnificent sight but little does the average tourist realize how it be-devils astronomers.

When the Mount Wilson telescope was completed Los Angeles was a city of half a million souls. It is now a metropolis of 1,500,000 and every other city in southern California has experienced similar growth. While the average population has approximately doubled in the last sixteen years the use of electricity has increased ten-fold. As a result there are many nights when the atmosphere over Los Angeles County is so flooded with light that the astronomers on Mount Wilson have to knock off work. Here is a potential fortune staring some genius of illumination engineering right in the face. All this light that escapes upward from the lamps of mankind—BILLIONS OF KILOWATTS OF IT EVERY YEAR—is senseless waste!

On Palomar every condition was found to be favorable for the full use of the 200-inch telescope. Along with all the other considerations the astronomers were looking for a dark spot—one that must forever remain dark because the surrounding topography will not permit the building of any great and well-lighted cities. From the site of the new observatory the lights of San Diego and Los Angeles are visible on opposite horizons. But they're far enough away not to worry the astronomers.

An astounding feature of Palomar Mountain is that there is nearly 30 square miles of fairly flat land on the summit. Thus, when the 200-inch telescope is set up inside a steel dome 135 feet in diameter that will house it, we shall see the

[*Continued on page 120*]

..With a HARLEY-DAVIDSON Motorcycle

What a pack of thrills you'll get out of owning a Harley-Davidson! The minute you swing into the saddle your chest will swell in sheer pride over the streamlined design and nifty color scheme—built-in instrument panel and 120 m. p. h. speedometer dial. Then get set for more travel pleasure than you ever dreamed of because Harley-Davidsons sure swing high on riding thrills. They've got greater sustained horsepower, greater strength, easier handling, and give you a gliding ride that packs every trip with joys you'll long remember. What's more—you'll get a new and bigger thrill after every trip when you see how these improved models swing gas and oil costs *way down to new lows!*

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My age is ☐ 16-19 years, ☐ 20-30 years, ☐ 31 years and up, ☐ under 16 years. Check your age group.

AMATEUR PHOTO PUZZLERS

In this department the Photography Editor will answer any question or problem relating to cameras of all types, enlarging, printing, developing, taking pictures, and the various phases of home movie making. When sending questions to this department, be sure to include a stamped, addressed envelope, so that we can answer directly in case space does not permit publication of the question on this page. Send all inquiries to the Photography Editor, Modern Mechanix, *1501 Broadway, New York, N. Y.*

CHEMICAL BOTTLE CLEANER THAT WORKS

I use D-76 and D-72 developers for negatives and prints, respectively. I find that the bottles containing these solutions become dirty after a while. I have tried both hot and cold water, but am unable to clean them. Can you recommend a cleaning fluid that will really work?—Aristide Carminati, Dayton, O.

A cleaning solution that really does the trick is quickly and easily compounded. Dissolve three ounces of potassium bichromate in thirty-two ounces of water and then slowly mix in three ounces of common sulphuric acid. The resulting mixture is cherry-red in color. To use it, rinse the bottle first in clear water to remove all traces of the developer, pour in some of the cleaner carefully so that it reaches all surfaces, pour the cleaner back into its own bottle, and then rinse the developer bottle very thoroughly in at least half a dozen changes of clear water. This cleaner is corrosive in action, so don't let it splash. It can be used over and over until dilution finally robs it of its strength.

A one-pound bottle of acid and a half-pound box of bichromate, together costing less than $1.00, will make up enough cleaner to last the average home photographer a couple of years.

HOW TO TAKE PORTRAITS OUTDOORS

I have taken a number of pictures of my friends outdoors but they don't seem to be very successful. Can you give me some suggestions on how to go about making portraits outdoors?—John Roentgen, Mobile, Ala.

Avoid taking pictures of people with bright sunshine shining directly in their faces. No matter how hard they try, they are bound to squint a little. Much more natural "shots" can be taken on the shady side of a building. Harsh shadows will be absent and the subject will be able to relax his features completely.

In taking pictures outdoors, also bear in mind the effect of the background. Many a good picture is spoiled because a mass of irrelevant objects unexpectedly shows up too well. Brick walls and trees present particularly disturbing patterns. If an unpromising looking background cannot be avoided, focus carefully on the subject and use a large lens opening to keep the depth of focus at a minimum.

REMOVING DIRT IN THE CAMERA

Please describe the correct way of cleaning a camera.—Arthur Tripman, Schenectady, N. Y.

A surprising amount of dirt accumulates inside a camera, especially if it is used outdoors. At the beach it is not unusual to find grains of sand inside the folds of the bellows. It is therefore a very good idea to get into the habit of cleaning the entire instrument occasionally with a small, fine-haired brush. Don't blow into the camera; your breath is laden with moisture and you may only drive the dust into a corner and make it stick there.

It is also very helpful to wipe both the back and the front of the lens once in a while. Don't use a handkerchief or the back of your tie. Invest ten cents in a book of rice paper, which is extremely soft and lintless and won't scratch the glass. Many a good camera is wrongfully condemned merely because its lens is dirty and its owner has never thought of cleaning it.

PHOTOGRAPHIC PRINT TERMS DEFINED

Please explain the difference between contact prints, projection prints and enlargements. I see these terms used a great deal.—Jens Jorgensen, Milwaukee, Wisc.

Contact prints are so-called because the paper is placed directly against the emulsion side of the negative and light is flashed through the latter by means of a suitable box system. Projection prints are made by shining light through the negative, through a lens a few inches away and then on to the paper, which is perhaps a foot or so from the lens. In its most commonly used sense, the term projection print refers to enlargements, a projection printer being known commonly as an enlarger. However, a projection print may readily be smaller than the original negative. Many enlargers designed for commercial work are fitted with optical reducing attachments, so that smaller prints can be made from 3" by 7" and 8" by 10" negatives, which are standard with professional photographers.

AMATEUR PHOTO ODDITIES

John T. Moore, Jr., of Seneca, S. C., took himself for a ride—in a wheelbarrow, and proves it with the above $5 photograph. The adage that photographs never lie can hardly apply to his picture. It is a double exposure made with a "duplicator" attachment fitted over the lens. The lower photograph which received this month's $5 award is not a view of the Endless Caverns, but a close-up of a stale loaf of bread made with portrait lens by Floyd W. Williams of La Jolla, Calif.

The increased interest in amateur photography and the many requests from readers for more articles devoted to this subject has resulted in a greatly increased photography department. You will profit by the many interesting articles that will appear in forthcoming issues of Modern Mechanix. Don't miss them!

The photography editor will pay $5.00 or $3.00 each for photographs interesting enough for publication on this page. All pictures should be mailed to Modern Mechanix, 1501 Broadway, New York, N. Y.

Inexpensive Accessories that pay Big Dividends in Finer Pictures

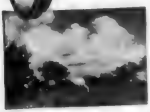
KODAK PORTRAIT ATTACHMENT

The ordinary hand camera is not designed to take pictures at extremely short distances. But a Kodak Portrait Attachment slipped over the lens of your Kodak or Brownie keeps the image sharp.

You can make "close-ups" of your family and friends, as well as clear-cut, close-range pictures of flowers, art objects, and still-life subjects in general.

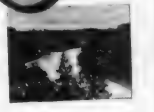
The attachment slips quickly over the regular lens. And the camera is operated as usual. Price, for most current camera models, 75¢.

KODAK SKY FILTER



Slipped over your regular lens, it holds back the light from the blue sky, and gives you beautiful cloud effects. The darker portion of your picture, the landscape, gets full exposure. Price, depending on camera, $1, $1.50, $3.30.

KODAK COLOR FILTER



Holds back blue and violet rays reflected from highly colored landscapes, gives weaker shades time to register. With it black-and-white pictures render all colors more nearly as the eye sees them; they're more natural. Price, depending on camera, $1, $1.50, $3.30.

KODAK ADJUSTABLE LENS HOOD

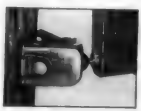
Prevents "lens flare" in bright light, in making artistic back-lighted shots. Two sizes, 85¢ and $1, depending on diameter of lens or lens attachment over which hood is to be used.

KODAK METAL TRIPODS

Light, compact, rigid; fit any standard tripod socket. Sections telescope neatly to give small collapsed size without sacrifice of strength. Three models, ranging from 13½ to 15½ inches long, closed. Nos. 1 and 2 have revolving heads; camera may be swung in any direction. Prices, No. 0, $2.75; No. 1, $4.50; No. 2, $5. Rubber tips, to cover metal spurs for indoor use, 10¢ for set of three.

KODAK SELF TIMER

Lets you get in the picture yourself. You clip it to cable release, set it, and, in a sufficient time interval, the shutter is automatically tripped. Price, $1.25. Cable release (specify name of camera) 35¢ additional.



THE KODAPOD

Toothed jaws grip tree or fence, other end threads into any standard tripod socket. Clamping screw adjusts camera to correct position. Carried in coat pocket. Price, $1.75.

KODAK POCKET RANGE FINDER

Used with any camera that has a focusing scale. Look through the eyepiece, turn the knurled ring until the two halves of the image are perfectly matched, and there's your correct distance, indicated by a pointer. Set for that distance, and subject is in focus. Spring pocket-clip. Price, $7.

SEE THEM AT YOUR DEALER'S

Eastman Kodak Company, Rochester, N. Y.

Science Builds Telescope

[*Continued from page 116*]

world's first astronomical observatory where aviation will serve countless purposes of transportation. A large aviation field is now being prepared beside the 640 acres of grounds set aside for the observatory and auxiliary buildings. Instead of grinding over the tiresome drive now necessary to get up and down the mountain by the present motor roads, the astronomers of the future will journey to and from their mountaintop retreat like bees going in and out of a hive. The observatory will be a flight of only a few minutes from the laboratories and shops on the Caltech Campus. Movements of personnel and equipment will be largely through the air. A system of short-wave radio telephones will serve all purposes of instantaneous communication.

Some intimation of the discoveries anticipated from the 200-inch telescope may be gained from the fact that the physical limit of distance with the Mount Wilson instrument was reached when Dr. Milton Humason photographed the spectra of a nebula 240,000 light years away. It had an outward velocity of 26,000 miles per second. With the 200-inch sky camera it should be possible to obtain similar spectra at a distance of five hundred million light years. If the distance velocity already established still holds, such nebulae would have a speed of 55,000 miles per second. If such velocities are real and present theories concerning them are sustained; and telescopes more powerful than anything now contemplated are eventually built, astronomers believe nebulae will be discovered moving at the speed of light.

On favorable nights the 200-inch telescope will give us better photographs of Mars, Jupiter and our other planet neighbors than any previously made. The images will be no larger than those already made with the 100-inch instrument, but they should be clearer. This is due to the fact that in the 100-inch telescope the light rays are weakened by being spread over the photographic plate, making a slow time exposure necessary to record them. In the 200-inch telescope the light rays will be more concentrated. They will not be blurred when such photographs are made almost like snapshots.

Make Metallic Manganese

Bright sheets of pure metallic manganese are produced from low grade ores by a new process of leaching and electrolysis developed by the U. S. Bureau of Mines. Success came in the hunt for a simple and cheap process when an ingenious method of maintaining constant acidity of the electrolyte used was discovered. Large manganese deposits in reach of Boulder Dam power will be made available by the new government research.

Artists Blow Glass Bottles

[*Continued from page 59*]

glass. Lo! We can plainly see all about the interior!

The molten glass resembles thick gravy simmering and cooking in some gigantic kettle. Over the bubbling mass, roaring gas jets are shooting flames. The glass cooks upside down, heating from the top!

The lake of glass inside is about 40 inches thick and is so hot it burns through fire-proof brick! A furnace which costs thirty or forty thousand dollars to build lasts, at the most, twelve months! Then another has to be constructed in its place. Cold air is constantly blown against the outside of the furnaces and in some instances, where the walls are becoming thin, a "plaster" of cooling water-pipes is attached.

One of the peculiarities of glass is that it sinks to the bottom as it purifies. This bottom layer runs out of a "throat" in the bottom of the furnace, and into a refiner. The refiner, while intensely hot, is not as hot as the furnace proper, and here the glass rests for several hours. Temperature for "cooking" glass is about 2,400 degrees Fahrenheit.

From here, the glass gradually passes into a shallow trough extending outside the furnace. A revolving pot continually turns the cooling substance back into the furnace, keeping the material at a uniform temperature.

Now begins the actual manufacture of bottles. To describe the bottle-making machine would be nearly impossible. There are over 10,000 separate parts! The machine itself works almost with human intelligence. It is careful and gentle—handling delicate, half-cooled bottles so easily they aren't even jarred—yet with strength enough to toss fifteen elephants around by their tails!

There are fifteen arms to each machine, and each arm contains a "thimble," a blank mold, a finishing mold and a bottom plate. The blank mold stoops and sucks the molten glass into its steel mouth, just enough to fill it. A "cut-off" whips by and alices the dangling, whispy slug free.

Revolving a short distance, the blank mold opens, and the stick of soft glass, looking like a home-made candle, is held in place by the thimble. The finishing mold now rises, and like an open hand, closes around the plastic material. As it does, compressed air hisses through the thimble and inflates the glass, blowing it out against the sides of the finishing mold.

In one complete revolution of the "spider" machine, the bottle is made. A chute is waiting, and as the arms swing by, a knock-out arm grasps the containers in turn and delivers them, via a belt conveyor, to the next step, the tempering "lehr."

Strange as it seems, all the heat the bottles have been through is not enough. Were they

[*Continued on page 150*]

Parts Exchange Plan Saves Money and Time for Ford Owners

CLUTCH DISC ASSEMBLY—Hubs checked or replaced to insure correct fit. New clutch facings. Exchange price, $1.75.

THE Ford Engine and Parts Exchange Plan offers Ford owners the modern, economical way to recondition their cars after thousands of miles of service. It eliminates old fashioned overhauls. It saves time. It saves money. And it enables Ford owners to maintain Ford quality and performance throughout the life of their cars.

The plan is simple. It substitutes a factory-rebuilt unit for the worn part. The replacement unit has been completely rebuilt at the Ford plant—by the same men and machines that build new Ford parts. The same high-quality materials are used. The same precision manufacturing is adhered to. And the rebuilt parts pass the same rigid tests and careful inspections as new Ford parts.

The Ford Engine and Parts Exchange Plan is an exclusive Ford service. Exchange units are available through Ford dealers and garages that display the sign "Genuine Ford Parts."

Prices subject to change without notice

DISTRIBUTOR—Completely reconditioned. All worn parts replaced. Rotor tested for dielectric strength. Exchange price, $2.

GENERATOR—Armature and commutator completely rebuilt. Worn or rough bearings replaced. New brushes installed. Adjusted for correct output. Exchange price, $4.75.

BRAKE SHOE AND PLATE ASSEMBLY—For 1937 cars, completely rebuilt. Brake shoes relined. Exchange price, $1.75. For models prior to 1937, recondition and reline brake shoes. Exchange price, 40c each.

FORD MOTOR COMPANY • DEARBORN • MICHIGAN

The Trailmobile

[*Continued from page 40*]

Exhaust heat is completely wasted. Once it was the custom to harness it for heating purposes, but the fear of leakage of carbon monoxide has retarded progress with this type of heater. Leakage can be, and is, prevented through the use of better materials and more effective fittings. As a matter of fact, the exhaust can be used for indirect heating, using air or fluid as the medium. This is the principle of the steam heater which is growing in popularity.

Refrigeration in the automobile can be either gas or electric in operation. There is much experimentation still to be done by way of cooling with exhaust gases, and engineers have by no means given up the idea of reviving tanked gas which on earlier cars furnished fuel for lighting purposes. The electric refrigerator of one of the latest trailers is battery operated, there being a special battery charger for use when the trailer is paying a visit to a camp offering current service.

One of the straws in the wind is the current announcement of a new replacement generator for use on all passenger cars. It is capable of delivering 28 amperes when required by the battery or by the connected load. The next step will be the offering of much larger batteries so that there will be a reserve of current for a variety of purposes. In the picture of the future touring car the dash will become a "convenience board." Not just clocks, gauges and the mildly useful glove compartment, but a thoroughly efficient "counter" on which, when folded forward for action, the driver and his companion can treat themselves at least to a simple roadside snack. Lacking actual mechanical refrigeration, the food will at least be kept cool and fresh with the aid of dry ice. There will be an electric coil to heat water, or to warm up a can of soup.

If the engine is switched to the rear of the car there will be all kinds of room ahead of the driver for storage space in which to locate these various conveniences. The car itself will also be very much redesigned so as to make it more homelike and to permit the use of things that go to make the modern trailer what it is today. We have a broad hint of this in the chair-type seat which has replaced the conventional automobile cushion on some cars. There is no reason why the steering wheel should protrude into the driving compartment when the driver is using the car as living quarters. Something on the order of the folding wheel which once graced earlier models of high grade cars would be just the thing. For that matter the wheel could be designed so that it could be removed temporarily, the post being folded up and out of the way.

Now that it is no longer considered strange to have "buggy whips" protruding above the car in order to improve radio reception, we may shortly expect to see windchargers on cars, another way of providing additional electricity. Many city buses pipe the exhaust gases to the rear instead of having the fumes emit low to the ground. This is the beginning of the chimney idea in the touring car of the future.

Unquestionably the great annoyance which puncture can cause with a trailer is going to encourage the development of stronger tires. Puncture-proof inner tubes will come into increased use. Whatever the motorist finds desirable in a trailer he will shortly want in his own car. Just one of these things is elemental proof construction and finish. Trailers are essentially outdoor vehicles. They seldom enjoy the protection of a garage.

The public welcomes compactness. It is one of the appealing features of the trailer itself. But since a trailer is of little use without something to pull it, the public is beginning to wonder why it is necessary to have two vehicles to do what one more compact craft could provide. From this reasonable "why" may come one of the most tempting products ever fashioned by the automotive industry.

In the meantime imagination is starting to run rampant in automotive circles. It is certain to revamp the automobile until the shopper will find the car itself, not merely the thing which provides propulsion for the trailer that follows, but a very complete means of highway living itself.

Tape-Measure Cartridge Varies Distance of Shot

A "tape measure" bullet from which the propelling powder can be withdrawn like tape from a tape measure reel and the distance which the bullet will travel thereby controlled, is described in a patent (No. 2,043,256) issued to R. D. McLeod, Jr., of the U. S. Army, at Aberdeen, Md.

In firing pieces of the Stokes mortar type, the powder charge sometimes comes in a box, or what is called a cartridge case. It looks like a coffee can. This is slipped down the muzzle of the gun with the projectile on top of it. The powder is ignited and the explosion hurls the shell toward its target.

To vary the distance the shell travels, it has been customary to take the top off the cartridge and scoop out the extra portion of the powder before loading the gun.

McLeod's invention eliminates the need for removing the top and taking out excess powder in this slow and inconvenient manner. He puts a slot in the side of the cartridge and rolls up the powder in the form of a strip, like a tape measure with the end sticking out of the slot.

The powder strip is marked off in yards which indicate how far the length of strip remaining in the cartridge will fire the shell. Thus by withdrawing parts of the strip and tearing the withdrawn portions off at the markings, the gunner can control the range, rapidly and without danger to himself.

JACK SMEAD, Service Manager, Illinois Automobile Club, SAYS:

"SAVINGS OF $19.38 IN GASOLINE"

(COPY)

Mar 31st, 1938.

W. H. Smith,
Memphis, Tenn.

Dear Sir:

In regard to your letter of May 23rd, with reference to the Stransky Gas Economizer for the Stransky Carburetor.

I placed a Stransky on my Packard and in a run from our Peoria to Chicago and return, a distance of 320 miles and used 10 gallons of gas. I had a saving of $19.38 for the one trip over the other.

I personally do not believe that a person is making a mistake in buying a Stransky for his car.

Yours very truly,

ILLINOIS AUTOMOBILE CLUB

Jack Smead
Service Manager

JS:ES

On San Francisco To Chicago Road-Test with Stransky GAS ECONOMIZER

Here's a Reproduction of a Letter Sent to W. H. Smith, Memphis, in Reply to his Letter Asking About the Stransky. What Motorist Wouldn't Like to Save $19.38 in Gasoline on a Trip from San Francisco to Chicago? It is Only one of Many Sensational Reports of GAS SAVING, MONEY SAVING with the Use of the New Improved Stransky Gas Economizer which Have Poured into our Office. No Wonder over 3½ Million Stransky's Have Been Sold—for all Makes of Cars—and Shipped to 77 DIFferent Countries. READ GENEROUS 30 DAY TRIAL OFFER BELOW. HOW YOU CAN TEST THIS REMARKABLE INVENTION ON YOUR OWN CAR FOR 30 DAYS and Even Get Paid a Bonus for Testing It If You are NOT Delighted With It. Then, MAIL COUPON BELOW.

Whether you own a Packard or a Ford, you know that your car eats up a big slice of your income. Automobile Engineers have proved that motorists are losing half the power of their gasoline by improper carburetion. The New Improved Stransky Gas Economizer aids motorists in recharing this pocket-book helps increase mileage from gasoline and thus SAVES GAS and SAVES MONEY. "After installing a Stransky, now getting an average of 32 MILES PER GALLON" says C. A. Anderson. "I can make 32 miles on a gallon of gas, where I made 23 before," says Eddie Mashak.

"37 MILES PER GALLON" SAYS A. J. HICKS

Automobile owners of practically every make of car report MONEY SAVING, GAS SAVING results—and many say it aids in reducing carbon and obtaining quicker pick-up, more power, faster speed. When gas is more thoroughly vaporized there is better mileage, more power and quicker pick-up, less up-keep expense and MONEY IS SAVED. The idea of the Stransky Gas Economizer is to super-charge the gasoline AFTER it leaves the carburetor—to make more complete vaporize the gasoline AT ALL ENGINE SPEEDS AUTOMATICALLY. Even a small amount saved on each gallon of gasoline in the course of a year's driving is well worth saving. Mr. Smead reports he saved $19.38 on his trip from San Francisco to Chicago. You may save less—you may save more. We'll let you test the wonderful Stransky Gas Economizer on your own car on 30 Days Trial and you yourself pay for the judge as to its GAS SAVING and MONEY SAVING FOR YOU—and should it NOT satisfy YOU the TRIAL COSTS YOU NOTHING.

FITS ANY CAR—EASILY INSTALLED

Costs no more than a good wrench—no more trouble to attach than a fan belt—anyone can install in ten minutes—absolutely automatic, self-regulating—there's no adjustment—and is guaranteed to last the life of the car.

"28 MILES ON A GALLON —was getting 18"
says H. T. TATE, Tenn.

"32 Miles on 1 Gallon of Gas." writes Mr. Bel.

"I got 28 Miles to a gallon where before used to get 12 and 15." reports F. Brand, Jr., Wilm.

"Eleven more miles per gallon," says Mr. A. Davis, Iowa.

Above are a few reports from thousands telling us how the Stransky reduced up-keep costs by getting MORE MILES PER GALLON OF GAS.

NEW IMPROVED GAS ECONOMIZER SENT ON TRIAL

FOR 30 DAYS—COSTS NOTHING IF IT DOES NOT SAVE GAS

and thus SAVE YOU MONEY. If you want to save auto running expense try the New Improved Gas Economizer on your own car for 30 days test under our liberal offer. Send coupon for your gas mileage BEFORE YOU INSTALL it—check it again AFTER YOU INSTALL it—then, if you are NOT delighted and are willing to return it under our liberal guarantee within the 30 day trial period, the TRIAL COSTS YOU NOTHING—but, that's not all, we will also pay you a bonus for testing it, if you are not delighted with it. So, you can't lose. The New Improved Gas Economizer is guaranteed to give you MORE MILES PER GALLON, quicker pick-up and more power, or IT COSTS YOU NOTHING—and YOU are to be the sole Judge. Send no money now—just sign and mail coupon below (or on a 1 cent postcard) for our 30 DAY TRIAL OFFER—tear out the coupon and mail it—TODAY.

MONEY MAKING OPPORTUNITY

SALESMEN—DISTRIBUTORS—CAR-OWNER DEMONSTRATORS

The Stransky has proven one of the most money makers for salesmen, distributors, over introduced. Two startling demonstrations mean customers, convince them, and make sales easy.

"$39 IN 3 HOURS

closed", says T. M. Wilson; he also says "the previous Saturday I closed $18."

E. E. Jackson, says "I sold ten in twenty-five minutes after I got them."

W. B. Eberlein says, "My best day's sales were 900 Vaporizers (wholesale) the most was 250 at another time I sold 23 in 24 minutes, and at another time 27 in 40 minutes."

Write quick for our offer which enables salesmen to get a SAMPLE AT NO-COST. Get full details about this quick money maker—mail coupon or post-card today—NOW.

J. A. STRANSKY MFG. CO.

L-600 Pukwana — So. Dakota

MAIL

FREE OFFER Coupon

J. A. Stransky Mfg. Co.,
L-600, Pukwana, South Dakota.
Without obligation, send me your 30 day Trial Offer and offer to pay me bonus for testing sample if I am not satisfied with it.

Name _____

Address _____

City _____ State _____

C Check here if also want to know how to make money and get offer of NO-COST SAMPLE to agents, salesmen.

How To Condition Firearms

[*Continued from page 81*]

cork. This bottle must be quite large, and must not be kept more than half full at any time as this solution gives off a powerful gas which might otherwise break the bottle. Add the ammonia and water to the powders, and store in a cool room. Keep the bottle tightly corked, and remember that the solution loses strength with age.

To use the mental fouling solution, clean the bore of oil and grease, cork the breech with a rubber cork and fill the bore with the solution. Stand the gun upright in the corner, and at the end of not more than one-half hour, pour out the solution. Knock out the rubber cork with a ramrod then pour boiling water through the barrel, and wipe dry with several flannel patches, followed with a light coat of gun oil. If there is any fouling left, remove with a bronze bristle brush, followed by another application of the solution, followed by cleaning, drying, and oiling. Never allow any of the fouling solution to remain on any metal part of the gun.

In rifles of the military type, which use ammunition loaded with potassium chlorate primers, the most serious threat to the gun comes from the salts which are formed by a salt deposited in the bore from the primer in the base of the cartridge. This salt, like common table salt, absorbs moisture from the air. No oil, or powder solvent, is of any use, therefore clean the bore by simply pouring boiling hot water through it, several times, followed by dry patches, and a light coat of oil.

To decide whether to use the first five steps or the three steps of washing with boiling water, drying, and then oiling, you must know whether or not the primers in the cartridges are of the potassium chlorate type or not. If they are described as "non-corrosive," it is safe to assume that you can follow the five-step method of cleaning; otherwise, we use the boiling water, and not the powder solvent.

A tinsmith can prepare a funnel with a bent nozzle so that the point will fit into the breech when the bolt is removed, (or the breechblock lowered in the case of a lever action rifle). Hold the rifle over the boiling water container, pour several dippersful into the funnel and let the water run back into your container, then pour it muzzle down. In this way you can use the same water several times.

Right methods, and correct solutions are important, but a careful selection of the proper cleaning rod should not be neglected. Brass rods, sometimes supplied with cheap weapons, are soft, bend easily, and scrape against the bore at various points as they work back and forth. If a piece of hard grit becomes embedded in a soft brass rod the effect is the same as emery cloth scraping away the steel. These considerations make a steel rod our only choice.

A jointed rod may break just when it is most needed, but it is convenient for carrying on a hunting trip. Another way to avoid the awkwardness of a long rod is to use a cord with a short piece of slotted steel at one end. This is dropped through the bore and pulled back with the patch attached, but this method requires some skill, and for field transportation warrants. For all practical purposes, clumsy as it may be, the solid steel rod, with a handle that permits the rod to revolve as the patch follows the twist of the rifling, is best.

The end of the rod may have a slot, a rounded button-like knob, or a short length of jagged steel. The objection to the slotted tip is that the patch may bunch up in the slot and cause the rod to become stuck in the bore, but this defect is no worse than the trouble encountered when the patch falls off the tip of the button just as the patch comes out the muzzle.

Cleaning patches should be of medium weight, canton flannel, previously moistened thoroughly with water and wrung out several times to make it more absorbent. They are cut in squares about ½ to 1½ inches square, according to the caliber of the gun, the size of the patch and the cleaning rod. The size should be that which will give a snug fit in the barrel, but not require more than a five pound pressure to drive it through the barrel.

A cleaning rack for rifles or shotguns can also be used to keep them out of way when not in use. It can be made of rough lumber at small cost in a few hours, and it will pay for itself the time saved in the cleaning and oiling process.

Modern ammunition is so nearly perfect that the competing manufacturers vie with one another in their claims for the merits of their products. One of the talking points in advertising is that the shooter need not worry about cleaning his gun after firing. It is true that cleaning is not as important as it was in the days of muzzle-loaders and flintlocks, but when we reach the day when cleaning and oiling can be entirely eliminated, it will be time to announce the arrival of the millenium.

"Tiny Tot"—Companion

[*Continued from page 91*]

connections are made. Be sure that all leads, *especially the detector section of the circuit, are as short as possible.* A very small capacity, such as that of two parallel wires provides a by-pass at these high frequencies.

The antenna consists of a copper rod or strip exactly 15 inches long. It is drilled at one end and fastened upright along the front panel by means of a fiber-through insulator.

The inductance is wound of No. 18 wire on a form 3 inches in diameter, and supported at both ends with insulators. The turns are spaced ⅛ inch. The form is removed from the coil, using air as the dielectric. One end of this coil fastens to the half-wave antenna, the other to the negative 135 or 180 volts "B" battery tap.

The tuning condenser is constructed exactly as was that for the transmitter described last month. Two semi-circular brass plates are used for capacity, each with a ¾ inch radius. One plate is fastened to the shaft of the spot dial so as to be adjustable. The other is fastened stationary. The gap should be ½ inch or less.

The moving plate of this condenser connects to the negative "B" battery supply while the non-moving plate goes to the antenna and to one side of the .00025 mfd. fixed mica postage stamp condenser. The opposite end of this fixed condenser fastens to the control grid of the 954 tube, and to one end of a 15,000 ohm, 1 watt carbon resistor.

The opposite end of this resistor goes to the negative "B" battery tap. The right hand tap of the potentiometer, looking at it from the back, also fastens to the negative "B" lead. The middle tap of this regeneration controlling potentiometer fastens to the screw grid of the 954 tube, while the remaining tap connects to the positive "D" battery tap. Insert a .1 mfd. fixed paper condenser between the center tap of the potentiometer and the "D" battery.

The radio frequency choke is wound of .32 gauge cotton covered wire, on a good dielectric form ¾ inch in diameter. The wire is smooth wound for 2 inches. The plate of this choke goes to the cathode connection of the tube, the other end solders to a 450 ohm resistor and an .01 mfd. fixed paper condenser. *Do not attempt to solder the tube contacts!* The heat generated by this iron will melt the glass envelope of the tube. The opposite ends of the 450 ohm resistor and .01 mfd. condenser solder to the moving plate of the tuning condenser.

The plate contact of the acorn tube connects to another radio frequency choke made the same as that above, and to one side of an .01 mfd. mica postage stamp condenser. The lower end of this fixed condenser is grounded to the negative "B" supply.

The remaining end of the r.f. choke makes contact with a .15 megohm, 1 watt carbon resistor, and a .1mfd. fixed coupling condenser. The lower end of this plate resistor goes to the positive "B" supply, and the other end of the .1 mfd. condenser connects to the control grid lug of the 41 tube socket, and one end of a 1 megohm, 1 watt fixed carbon resistor. The screen grid of this power tube connects to the "B" battery positive tap, no bypassing condenser being necessary.

The 41 audio amplifier is self-biased through a 600 ohm fixed carbon resistor, mounted by an .01 mfd. fixed paper condenser. This combination is connected between the cathode tap of the 41 tube and the ground at the negative "B" supply.

The plate lug of the 41 socket makes contact with one side of the open circuit phone jack. The other side of the jack connects to positive "B".

The filaments of both tubes are rated at 6.3 volts. They are connected in parallel as shown, and may be operated from four dry cells or a six volt storage battery.

In operation, the regeneration control should be turned up until there is a hiss in the phones or speaker. Then turn the tuning dial until a station is heard. Due to the broadness of the ¾ meter band, and to the fact that it is little used at present, it is unlikely that any stations will be heard unless you have arranged to contact a friend with a transmitter.

If, when trying to establish contact with a friend at a predetermined time, you are unable to tune in his signal although you know he is on the air, don't jump at the conclusion that something is wrong with your receiver. Often, by moving the receiver just a few feet in one direction or another, the signal may come in loud and clear. It is one of the idiosyncrasies of the quasi-optical band that signals inaudible at one location will come in very well just a few feet away.

Much remains to be discovered in the ¾ meter field, and it is probable that this band will some day be in popular use, due to its broadness, for television. ETHER IMP and TINY TOT are an ideal combination for the radio amateur who wants to explore the fascinations of this new and interesting field.

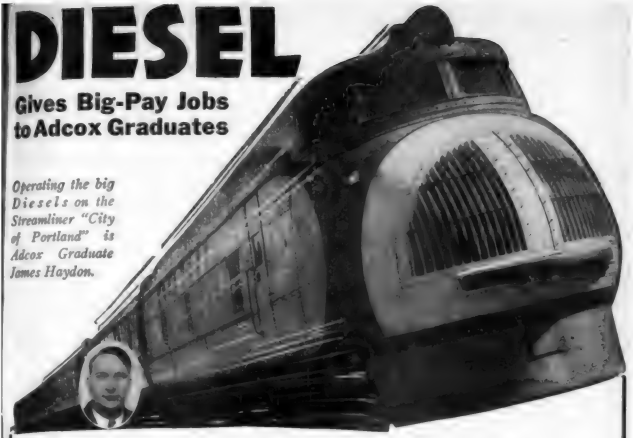
PARTS LIST FOR TINY TOT RECEIVER

7 ¾" stand-off insulators.

[*Continued on page 126*]

DIESEL

Gives Big-Pay Jobs to Adcox Graduates

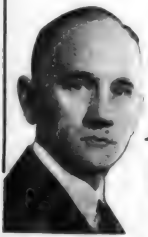


Operating the big Diesels on the Streamliner "City of Portland" is Adcox Graduate James Haydon.

How would you like a big-pay Diesel job like James Haydon's—like countless other successful Adcox Graduates hold down? They are in the fascinating, fast-growing Diesel industry RIGHT—the **special advantages** of Adcox Training put them there! Isn't that exactly what YOU are looking for?

Let me put my 27 years' experience to work for YOUR success, just as I have done for James Haydon and many others. Send at once for my new, big, FREE, 40-page catalog. It tells you frankly *why* you should study in the thrilling Pacific Northwest, home of the Adcox School and a "hotspot" of Diesel activity and employment — straight-from-the-shoulder facts you should know before choosing *any* trade or *any* school.

You owe it to yourself, your future happiness, your ambition for success in life to learn, first hand, of the exceptional opportunities before YOU as an Adcox Graduate. Earn board and room while learning. Get my valuable Catalog without further delay—



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Send This Coupon NOW!

BIG 40 PAGE DIESEL SCHOOL CATALOG FREE

Mr. L. L. Adcox, President,
L. L. Adcox Trade School,
Portland, Ore.

Without obligation please send FREE Diesel Catalog No. 19-O. I am interested in ☐ attending school. ☐ Home study.

Name ..... Age .....

Address .....

Town ..... State .....

Ready Now! Allied's
1938 RADIO
Catalog!

Everything in Radio at Lowest prices

61 Amazing New Radios!

New 1938 KNIGHT Radios with astounding features—Push-Button Tuning, AFC, Beat Power Tone, Armchair and Plastic cabinets! 9 to 16 tubes—All Wave, Dual Wave—AC, AC-DC, 6 Volt 32 Volt, Battery and Auto sets!

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Every type of test instrument!—new 3" Cathode Ray Oscilloscope, tube-checkers, set-testers, analyzers, meters. New Build-Your-Own test instrument kits, including latest 20,000 ohms-per-volt equipment. All standard lines.

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KNIGHT "Integrated" P. A. Systems—every unit perfectly matched—8-50 watts—permanent, portable, mobile—110 Volt A.C. and Universal operation. Also KNIGHT Intercom Systems.

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See the largest selection of Amateur Equipment in Radio! New RCA-ACR 111, Hallicrafters, Hammarlund, new Utah "Q-meter"—latest transmitters, receivers and transceivers—in factory-built and kit form!

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Write for Free Parts Lists covering: Hitch-Hiker' Portable; 2 Tube AC-DC; Bicycle Set; 1 Tube A-W; Combination Set; Ether Imp. etc.

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☐ Send your FREE new 1938 Catalog.

☐ Send Free Parts Lists for.....

Name .....

Address .....

"Tiny Tot"—Companion

[Continued from page 124]

1 ¾" feed-thru insulator.
1 electralloy panel, 4¼" by 6".
1 electralloy sub-panel, 2¾" deep, 1½" high, 4¼" wide.
1 port dial, 1 black pointer knob.
1 1½" length copper tubing or strip.
1 brass plate, 1½" in diameter, cut in half.
1 foot No. 18 copper wire, enameled.
25 feet No. 32 cotton covered wire for r.f. chokes.
3 inches fibre or bakelite rod, ¼" in diameter.
1 50,000 ohm potentiometer, with switch on back. (D.S.T.)
3 fixed condensers, .01 mfd. capacity, 2 paper type, 1 mica
1 .00025 mica type fixed condenser.
2 .1 mfd. paper type fixed condensers.
1 15,000 ohm carbon resistor, 1 watt.
1 450 ohm carbon resistor, 1 600 ohm carbon resistor.
1 .15 megohm carbon resistor, 1 watt.
1 megohm carbon resistor, 1 watt.
1 acorn tube socket, type 954.
1 type 954 acorn tube.
1 six-prong socket for 41 tube.
1 type 41 tube.
1 set of phones or loudspeaker.
1 six volt storage battery, or 4 dry cells.
3 or 4 45 volt "B" batteries.
1 open circuit jack for phone connection.
Hook-up wire, solder, miscellaneous bolts, etc.

He Was An Inventor At 10!

[Continued from page 61]

had already established himself as a regular electrical contractor. He did his contracting work in the evening and attended school in the daytime to further his technical education.

The blossoming art of radio communication deeply intrigued him and he made many notable contributions to it. He travelled extensively and left his mark in many corners of the world. Today, apparatus bearing his name is manufactured in huge factories in the United States, Great Britain, France and Germany. Practically every important manufacturer of electrical equipment has taken out licenses on one or more of his many patents.

In spite of the growth of huge industrial organizations and plant laboratories manned by hundreds of scientists, Dubilier believes that the opportunities for the young, independent inventor are still unlimited.

"The modern laboratories of the big, industrial firms unquestionably have performed many miracles in the development of new ideas and processes," he says, "but the cellar or attic tinkerer, in many cases, has just as good a chance of conceiving a new idea that may readily bring him a fortune overnight. I have never forgotten the crudeness of the apparatus I worked with as a boy, and how limited my facilities were for experimenting."

Still an inveterate experimenter, Dubilier regularly spends several days a week in his well equipped laboratories in South Plainfield, New Jersey and devotes the rest of his time to his skyscraper office in New York, where the merit handling of his patent interests is a big business all itself.

Concealed from the Eyes of Man

A Secret Sought For 3000 Years!

An elixir to prolong life!

A strange process to change the composition of metals!

A weird device for communication with distant planets!

Did the ancients accomplish these things? Were they masters of a lost wisdom? Down through the ages these rumors persisted. Was it possible that a vast knowledge accumulated by forgotten civilizations still existed? Tales of strange phenomena gave support to the belief that there was hidden from the world stupendous secrets of nature, possessed by a chosen few.

To the far corners of the earth journeyed men in search of these gems of wisdom. To the finder would come fame, power, wealth. Tyrant and peasant alike strove to find this, the greatest of all treasures —a mastery of nature. One man had the key. He alone seemed to know the answer.

To Roger Bacon, medieval monk and scholar, man of mystery, the eyes of the world turned. He accomplished feats at which the peoples of the eleventh century gasped. They begged and implored him to divulge his formulas, to reveal his source of wisdom. To these and their threats his lips were sealed. He knew the wisdom was too powerful, too dangerous to be in the hands of those who might locally use them.

For generations his manuscripts were a hopeless confusion of strange hieroglyphs and symbols. Then in recent years came their decipherment, and the world learned of many of his great experiments and the source of his tremendous knowledge. He was one of a secret brotherhood which had carefully guarded in code the great knowledge of the ancients.

OBTAIN THIS FREE *SEALED* BOOK

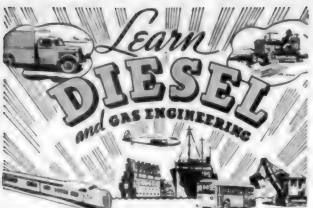
Today this great brotherhood, known as the Rosicrucians, still flourishes. It still keeps from the eyes of the curious, as in Bacon's time, the profound truths of nature, which give man mastery of self and happiness in life. Its keys of universal wisdom are extended to all who are sincere in their desire to unlock the hidden truths of the universe and find freedom, power, and success in such knowledge. A fascinating free book, "The Secret Heritage," will explain how you may receive these helpful facts. Direct a letter to the address below, asking for it.

SCRIBE L. S. W.

The ROSICRUCIANS

« AMORC »

SAN JOSE, CALIFORNIA, U. S. A.



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To qualify for a good Diesel job you must receive training in an institution that can offer you *practical* instruction. At National Schools you actually work on the latest equipment, including practically every approved make of Diesel engine. You get the kind of instruction that serves your every day needs in the Diesel field after you have graduated. It's the type of training you can "cash in" on. You are trained under the direct, personal supervision of licensed Diesel Engineers.

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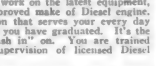
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ADDRESS .....

CITY..... STATE.....

"Tinker"—A Midget Dinghy

[*Continued from page 95*]

inch or even ¼-inch rope (manila) is best employed. ... standing rigging should be light stranded galvanized ca...

The floorboards should be laid over an old rug or ... similar material to protect the hull. *Finally*, if you don't know much about sailing, exercise care in using the b... until its operation is thoroughly understood.

Photographic Name Card

[*Continued from page 111*]

then photographed to size on commercial film. This ... be done with a plate camera or an adaptation in order ... the photographer may see and control the size of his ...

When the film is developed and dried, contact prints ... be made on any suitable double weight paper. The ... surfaces may be varied according to the individual's ... Striking effects may be obtained with linen and ... surfaces.

"Dutch Duck Railway"

[*Continued from page 76*]

The apron below it can be of plywood or solid stock, ... with a hole large enough to make it possible for the aver... passenger to strike it after some practice.

Construction of the car requires only plywood and a s... saw. It is assembled throughout with casein glue and scre... Two wood chassis-members carry the skate rollers. T... turn on bolts the proper size for the ball bearings. Washe... should be placed each side of the roller. An angle brac... screwed to the bottom of the car prevents the rollers ... ends of bolts from rubbing against the side rails.

When used for charity affairs, an inexpensive, but show... prize can be offered patrons who, of course, take their ... chances on getting a cloudburst. It is apparent that ... amusement device will draw large and hilarious crowds, ... good idea is to have a practiced assistant make a trip, ... and then, to give the impression that it is easy to str... the hole under the barrel.

Tricks With Matches

[*Continued from page 75*]

lease the finger tension on one match so that the other c... pass under it without detection. One end of the match wi... adhere to the fingers sufficiently so that the passage of th... one match between the bottom of the other and thumb w... not be detected.

Some amusing results can be had from the fact that so... will repel small floating objects while blotting paper ... cubed sugar will attract them. This action is due to a su... which spreads over the water when the soup touches it. Th... sugar on the other hand, or the blotting paper, absorb... water and draws anything floating, toward the substance...

[*Continued on page 135*]

Humidor Combines Pipe Rack

[*Continued from page 98*]

Four small decorative lips are next cut from No. 18 ... copper, and riveted at equal distances between the lon... strips as exemplified in the photograph of the complete... humidor. To the decorative lips, and the lips on the ... of the long strips, are attached rings formed from ... or brass wire to a diameter of 1 inch.

The drum and accessories are fastened together with ... No. 16 escutcheon pins which serve an excellent ... rivets. The ends of the rivets may be cut off with ... snips so that they can be flattened with less difficulty.

Around the inside of the drum rivet in position a ¼ inch ... by 14½ inch strip of copper to form a support for ... bottom. The bottom is a circular piece of copper measur...

[*Continued on page 135*]

New Invention WITH SUPERCHARGE PRINCIPLE SAVES GAS

AT LAST! Automotive engineers have smashed down the barriers to perfection! The new VACU-MATIC solves the secret of greater power! With almost magical action, this amazing invention instantly puts new life and pep in any motor. It adds mileage to every gallon of gasoline . . . produces split-second pick-up, sensitive accelerator response, quicker starting, greater speed and smoother running.

— Nothing Like It!

The self-starter — four wheel brakes — knee action — streamlining . . . and now VACU-MATIC! The sensational money-saving invention! With it, engineers have achieved a practical means of balancing air and gasoline automatically for all speeds.

VACU-MATIC is *entirely different!* It operates on the supercharge principle by automatically adding a charge of extra oxygen, drawn free from the outer air, into the heart of the gas mixture. It is entirely AUTOMATIC and allows the motor to "breathe" at the correct time, opening and closing automatically as required. No idling troubles—no carburetor adjustment necessary. It is so simple it will amaze you—so practical it will save you many dollars on gas costs.

USERS REPORT
3 - 7 MILES MORE PER GALLON
MOTORIST SAVES $120.00 a YEAR

"On my V-8 Ford 6 months records, the VACU-MATIC saves me 3 miles per gallon on gasoline."—Ralph Fuller, Ind.

"Has given me 7 miles more per gallon."—Jos. Kelly, Ill.

"My Pontiac 6 showed an average of 5 miles more per gallon."—Jos. Kelly, Ill.

"On my Plymouth, I obtained an average of 22 miles per gallon. Now I average 27 to 28."—W. J. Peck, Colo.

"Has given me gallon a day and a half more on my Chevrolet."—Jos. Kelly, Ill.

"Saves me 5 gallons on Ford."—Jos. Kelly, Ill.

"Have installed VACU-MATIC on my new truck and find it saves me money every day."—Jos. Kelly, Ill.

"I intend to put VACU-MATIC on my Chevrolet."—Jos. Kelly, Ill.

"I am now placing VACU-MATIC on many of my friends' cars."—Jos. Kelly, Ill.

"I plan on placing VACU-MATIC on my Ford."—Jos. Kelly, Ill.

Guaranteed Gas Savings

VACU-MATIC proves itself on every car. It is guaranteed to give worthwhile gas savings, quicker pick-up, and more power or it costs you nothing. You can instantly tell the difference in added power and motor performance — you quickly notice the cash savings on gasoline.

Fits All Cars

VACU-MATIC is constructed of six parts, assembled and fused into one unit, correctly adjusted and *sealed at the factory.* Nothing to regulate. Any motorist can attach VACU-MATIC in ten minutes. Choice is, as only manufacture is the magic of instant power and speed it gives to the motor and the savings it affords your pocketbook.

Free Details

You owe it to yourself to know all about this remarkable discovery. Mail the coupon below. Start saving gas with VACU-MATIC and enjoy a new driving thrill! There's no obligation—so get the facts now! Write today!

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☐ Check here if interested in selling proposition.

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NATIONAL POTTERIES COMPANY
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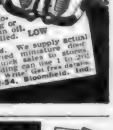
STOP THAT SLAM!



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AUTOPOWER tells you how in plain, easy, simple and illustrated instructions that anyone can follow. Change auto generators into useful electrical A C and D C generators and motors with voltage from 2 to 1,000 volts, for power, light, welding, radio, sound, etc. No previous experience nor special tools needed. Generators can be driven by wind, water, fan belt, etc. Already used and endorsed by thousands. Send for your copy of "AUTOPOWER." Only $1.00 postpaid.

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No soliciting! No canvassing! We show you how to make big money decorating fast-selling Giftwares. We start you with the big $10 Artist's Outfit shown above. We supply you with $150 worth of Giftwares free of extra charge and show you how to dispose of them without leaving your home. We give you 29 Tested Plans for making money. One Fireside Member says, "I made $100 on furniture in one week." Another writes, "My sales were $500 for 3 weeks. This is my first year." H. M. P. of Ill., says, "I did $5,500 worth of business last year and over $12,000 this year." D. W., New Mexico, reports, "I would not take $1,000 for my Course."

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Design For An Ancient Lamp

[*Continued from page 77*]

lower blade is not beveled but the edges are rounded off and sanded smooth.

The handle is likewise made from spruce and drilled throughout its length with a ¼ inch drill. It is best made on a lathe, and the end sawed off as shown. It may be made if desired from square stock with the edges rounded.

Continue by cutting a slot in the handle for the insertion of the blades. This must be a "force" fit, but care must be taken so as not to block up the hole through the handle for the cord. With a short ⅛ inch pipe nipple and nut, affix a lamp socket to the end of the handle as shown. Do not use a pull chain socket.

With a veining tool, make shallow cuts in the shield to divide it into four areas and sand smooth. Insert the lug into the slot in the shield, and check the alignment of the socket with the shield, as these must be in parallel planes. Use hot glue and brads to attach the blades to the handle and the lug to the shield.

Stain the opposite areas of the shield, and enamel the remaining areas brown or red. Stain the handle and bronze the blades.

When dry, insert two screw eyes in the shield in the manner shown and wire the socket. Unless the outlet for connection is nearby, it is advisable to gouge a groove in the back of the shield for the cord. The lamp is completed by attaching a small parchment shade of the type that claps over the bulb.

Taking Twelve Pictures

[*Continued from page 113*]

long edge of each cardboard mask and insert this under the film rollers where they are held in place by the friction of the spool.

To take 12 pictures, on the 6 exposure roll, load the camera with film in the usual way; then turn the film key until No. 1 exposure appears in the top index window. Snap the picture, and then turn the film key until No. 1 appears in the lower window. Continuing this procedure for each number will result in 12 exposures for each roll. Bear in mind that the view finder will have to be used with some judgment, inasmuch as pictures will be smaller.

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The newest stream-lined automobiles are the culmination of more than 100,000 individual patents, according to a search made by patent examiners.

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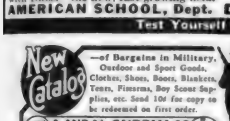

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Amazing midget radio weighs only 3 ozs. complete. Receives all stations with clear beautiful tone. No static or interference. Nothing to wear out, wear out, rebuild (we've never had one). Not to be confused with cheap novelties. "Boy! Radios!" Music and programs come DIRECT to your EAR—NOT OUT OF RADIO. Has patented new "Speakerphone" which gives more volume and stations. NOT A TOY. Tunes broadcast band, police and airplane calls. The newest radio sensation of the year. Absolutely complete with instructions for use in hotels, autos, boats, in bed, etc. TAKES ONLY A SECOND TO CONNECT—no messy soldering. 50 ft. aerial and no extra wires. SATISFIED OWNERS report wonderful service in ALL PARTS OF THE WORLD. THESE ARE FACTS. Beautiful two color cabinet in six colors.

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The Safest and Handsomest .22 of All, Model 2x $5.75

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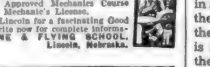
Slips into Any Old Range, Heating or Cooking Stove; Does Away With Coal or Wood; No Dirt or Ashes; Cheaper.



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AGENTS Salesmen
BIG MONEY
It's a sweeping success. Get YOUR OWN BURNER FREE and make REAL MONEY. Write quick.

Quick Heat at TURN OF VALVE

COOLER KITCHEN IN SUMMER

Scan Skies With Telescope

[*Continued from page 87*]

worker may apply the test equally well when he understands the theory or not.

First of all, the light source must be placed so that the light from the pin hole is reflected into the eye of the worker. This is done by moving the pin hole slightly to one side of the center of the mirror. If the light is in the exact center the rays will return into the pin hole. Therefore, we move the light source a little to one side and move our eye until the light is reflected into it. A small piece of ground glass, such as is used in a camera, will be useful for finding this returning point of light. The mirror will then appear brilliantly lit across its entire surface.

Now cut off part of the light from the mirror with a knife edge (this is shown in the accompanying diagram). If the knife edge is inside the focus of the mirror, i. e. between the surface of the mirror and the point of focus, its shadow will move the same way as the knife edge. If the knife edge is outside the focus of the mirror the shadow will move in the opposite direction from the knife edge itself. If the knife edge is exactly at the point of focus of the mirror, a translucent shadow will darken the mirror evenly over its entire surface.

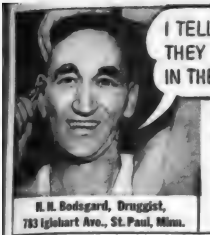
It is now only necessary to measure the distance between the surface of the mirror and the knife edge to discover the focal length of the mirror. This can then be compared to the desired focal length and corrections in polishing made accordingly.

Unfortunately this matter is rarely simple. Usually the surface of the mirror is irregular; there are hills, valleys and ridges. Some parts of the mirror come to focus at one place, and some at another. However, this is shown by the Foucault test, for the mirror appears to darken irregularly, the depressions and ridges showing in sharp relief. If, when the light source is outside the focus, the advancing shadow is straight along the edge, and the same is the case when the light is inside the focus, there are no irregularities in the surface of the mirror. The Foucault test is also employed in obtaining a parabolic curve.

Before attempting to straighten out the irregularities of your mirror, achieve a good polish on the surface. This will take eight to ten hours of polishing. By this time the pits and scratches, as shown by the reading glass test, should have been removed. All that remains to be done is to take out the irregularities in the curve, and silver the mirror.

If you are grinding a parabolic mirror, your troubles have only begun, as the parabolic curve still has to be achieved. However, if you are attempting a long focus mirror as described in this series of articles, there is very little likelihood of your having great difficulty with irregularities in the surface. However, should you find that your mirror, under the Foucault test, looks like

[*Continued on page 139*]



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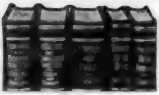

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Range Finder For Focusing

[*Continued from page* 110]

space will permit. The mirrors are of course cut with a glass cutter, from the best piece of thin silvered glass mirror you have available. The upper mirror is 1x1¾ inches, and the lower 1x1½ inches in size.

The latter is used without alteration but the top sighting mirror, as mentioned previously, must be almost transparent. This means that most of the silver must be evenly removed, so that you can see through it and at the same time enough silver remains to catch the image reflected from the lower mirror.

First remove the backing varnish with benzole or any other suitable solvent, then partly remove the silver film with a very dilute bath of nitric acid in water. Photographic reducing solutions are also very good. Farmer's reducer is as satisfactory as any, and clean working. If you are not already familiar with the formula, use a 20 per cent solution of plain hypo and add sufficient potassium ferricyanide solution to give it a lemon-yellow color. After most of the silver has been dissolved, rinse and dry the mirror. Mount it with the silvered side to the front.

The thin film of silver that remains may be protected with a coat of very thin clear lacquer. *If the latter is colored a very light rose tint, the completed range finder will show one rose-tinted image and one plain image.* This is a definite aid in quick focusing, particularly under poor lighting conditions. Another variation is to set small 1½-times magnification lenses in the apertures so as to increase the size of the images. This improvement may be added later, if you wish, and is not really necessary when cost is a consideration.

The coupling or control arm is of course one of the most important parts. Cut it from a sheet of stiff steel and reinforce it against bending at the corner. Couple it to the lens mount of the camera and insert the end in the range finder housing; then, focusing on a distant and a near object, mark these points so that the space between can be graduated with a file. This is not difficult and requires only that you test the arm frequently while filing it.

Plan Soviet Bathysphere

The Institute of Oceanography at Moscow, Soviet Union, has set designers to work planning a bathysphere capable of withstanding the enormous pressures to be encountered in an under-ocean descent of one and a quarter miles. The bathysphere of Dr. William Beebe of the U. S. A. had a volume of 1.2 cubic meters. The new Soviet bathysphere will have a volume of 4.2 cubic meters and be large enough for three scientists.

Tricks With Matches

[*Continued from page 128*]

Fortune telling with this method will have to resort to replies of "yes" or "no" or such silliness as "Does Frieda like Johnny?" Roll up a piece of blotting paper and fasten with rubber bands. In one end insert a small piece of soap, in the other cubed sugar. The performer lays two matches on the surface of water causing them to come together or move away, depending upon which end of the "wand" is brought in contact with the water's surface.

Humidor Combines Pipe Rack

[*Continued from page 128*]

4½ inches in diameter, soldered securely to the copper supporting strip.

The humidor lid is of copper to lend the necessary contrast to the project. Cut this from No. 18 gauge sheet copper to a diameter of 5½ inches, tap it with the ball-peen hammer to give it the desired effect, then hammer it to shape over a hard wood block measuring 4½ inches in diameter. This operation is best accomplished by clamping the flat copper disc and block between the jaws of a vise and hammering down the edges in a uniform manner. After the block has been removed, round the top slightly by tapping it with a rubber mallet. The handle for the lid is cut from a strip of copper, 1 inch by 4½ inches long and given a decorative trim, as shown in the details, then fastened in place with escutcheon pins.

The humidor set is completed by making the copper tray. Cut a 9 inch disc from No. 18 gauge metal and hammer it into shape. The edge should be raised to a height of ½ inch and flared out slightly at the top.

The humidor's appearance can be greatly enhanced by proper treatment of the metal. The first step is to remove all dirt and grease from the copper parts by rubbing with steel wool. This completed, dissolve a small piece of Liver of Sulphur in a quart of water and applying the resulting solution to the copper with a small cotton swab until the metal takes on a very dark brown color. Allow the chemical to dry, then buff and finally apply a coat of clear lacquer to the metal so as to protect the finish.

Television Range Finder

A television range finder which would automatically reveal the position and range of enemy ships so that mighty defense guns could be directed with unerring accuracy to blow them up, is described in a patent granted to R. H. Somers, James L. Guion, both of the U. S. Army, and James C. Karnes, of Buffalo, N. Y.

The novel range finder is intended to eliminate any human error and may be used on battleships or on land. It comprises two television cameras spaced apart a known distance.

The cameras are connected electrically to a television receiver where the scenes picked up by the cameras are thrown on view plates. The observer automatically regulates the television cameras to sweep the field so that they are both directed at the same target, which may be an enemy ship.

The device would be adjusted until the images of the ship appearing on the view plates of the television receiver exactly overlap. This means he has a "bead" on the ship.

To get the range, the observer merely has to glance at a chart. Upon this the information has been continuously indicated by a plotting device which acts in synchronization with the "focussing" of the cameras to plot automatically the exact range and azimuth bearing for the guns.

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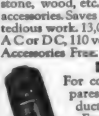

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Novelties Made From Records

[Continued from page 105]

enough current, when attached to a 110-volt circuit, to heat the resistance wire to a dull red glow. Drop cord is used to make the connection between the socket and the binding posts at the ends of the arms.

The arms are slightly sprung together for when the resistance wire is installed the heated wire expands to some extent. The record is moved up and down as the cutting is done. It is necessary to go around the cuts twice as they fill in slightly making it unsafe to attempt to break the pattern loose when the records are cut up into intricate designs.

Wall brackets, plaques, novelty picture frames and mirror scrolls are readily made from old records. The patterns are cut out of paper and glued to the back of the records. The cutting is then done around the edge of the pattern and the pattern is washed off when the cutting is finished. The paper pattern is folded down the center and both sides cut at the same time to insure uniformity of design. Do not make the patterns too elaborate, or any parts of the design too thin, as they are easily broken if care is not used.

The edges will be rough after cutting, therefore they must be smoothed off with sandpaper and files. A flat, round and half round file will be needed in order to finish all of the edges. Rather coarse files work the best on this material. The records can be drilled with regular metal drills, but light pressure must be used. The back of the records should be washed with soap so as to remove grease that has been deposited by continuous handling, otherwise they will not stick. Any good glue can be used to assemble articles made of two or three parts, such as wall brackets and decorative lamps.

Visit Worlds With Microscope

[Continued from page 104]

fibers; that clump of mordenite needles, so ethereal and fairy-like in their fragile splendor. How does one distinguish between ocean beach sand and dune sand? Between sand particles in the soil and clay particles? Is this soil of glacial origin? Is it suitable for such crops as cotton and corn, or is it better for wheat or for truck crops? All of these and many more questions you can readily answer for yourself, after a bit of experience.

Crystal study always brings one into the field of chemistry, where the microscope is a tool of great importance, giving much valuable information concerning the structure of various elements and compounds. The preparation of slides to show chemical crystals is easy and highly interesting. In physics, this instrument, in one of its variously modified forms, is employed in analyzing light and in making all sorts of tests

as to composition, structure, strength and other qualities of objects.

These uses are of great importance to industry, where the microscope is king. You may have read that Mr. So-and-So bosses the steel industry, or the rubber or paint or oil organizations. As a matter of fact, the microscope is the real boss, telling them all what to do and how to do it to achieve the desired results.

A flaw in a steel rail can cause a serious train wreck which perhaps costs many lives and much destruction of property. Such accidents used to happen all too frequently in the days before the microscope was employed to detect imperfections and to control the alloying of iron with other metals to give us the many types of modern steels, each with a specific function. Iron, nickel and chromium give a stainless and very hard steel, useful in making tools, armor and decorative panels, while iron and manganese form a steel of great toughness and resistance to friction or strain, as is needed for railway crossing frogs and switches. And so it goes.

Paints have to be tested for perfect matching of color, for hiding power, wearing qualities and weathering, particle size and dozens of other factors; oils must be of a certain viscosity, leather of a given density of fiber-matting, wood paper pulp of fibers having certain diameter, length and numerical occurrence. With a microscope one can tell from what animal a designated piece of fur was taken and hence whether it has a genuine or a spurious label; whether a given splinter of wood is oak, maple or elm; whether this food product contains injurious adulterants; if this dye has fine or poor powers of penetration.

The textile industry is one of our largest and depends utterly upon information which only the microscope can impart. Here is another trip on which you will wish to go: mounting and studying the fibers and the fabrics of cotton, linen, real silk and the many rayons; analyzing them and comparing them and learning their respective features of merit. The food and drug excursion is still another intriguing department in microscopy. What do sugar, salt, pepper, tobacco, corn starch, potato starch and wheat flour look like when magnified? What is put into this brand of table salt to make it free-running and is it wholesome or deleterious? Will the abrasive substance in this particular tooth paste injure the enamel of the teeth? On and on go the journeys, through ever-fascinating lands, exploring ever-new wonders.

Lately, a very novel and highly entertaining field has been opened: scientific crime detection. Your real G-man, the one who furnishes the evidence upon which arrests can be based and convictions assured, sits behind a microscope, not a machine gun. Fingerprint identification and classification is fundamental and requires a low power lens; bullet scratches, samples of handwriting or typewriting, the texture, ink color

[*Continued on page 138*]

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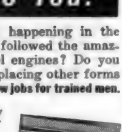

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Visit Worlds With Microscope

[*Continued from page 137*]

and other features of typewriter ribbons and a host of similar forms of evidence are examined under the ingenious comparison microscope, which sees parts of two different objects as a single whole.

Take a specific case. An alleged homicide is committed. It might be suicide, though, as the victim is found with a revolver clutched in his hand, and only a single shell in the chambers has been fired. The police discharge another cartridge from this gun into a bale of cotton, reclaim the slug and examine it under the comparison microscope together with the bullet which autopsy surgeons have removed from the body. The rifle scratches cannot be made to coincide. Hence the lethal bullet was not fired from this pistol and the case is one of murder and not suicide.

Later another comparison is made with a projectile shot from the weapon of an arrested suspect. The scratches tally exactly. Confronted with this indisputable evidence, the criminal confesses or a conviction is secured. Science and the microscope triumph over noncommittal circumstances.

In addition to activities with the microscope alone and in making slides, special detours will lead us into the bypaths of microprojection, as done for demonstration and drawings, and photomicrography, where the camera and microscope form a partnership to provide one of the most enthralling pastimes—the art of making photographs through the microscope.

In succeeding issues, MODERN MECHANIX will present a series of journeys with the microscope, taking passage to each of these strange lands in turn. Join our party and go with us on these adventures. They will prove of interest to youngsters and oldsters and in-betweens—to everyone who has even a germ of curiosity and flair for science. Get your microscope ready for next month's submarine voyage through the microcosm. Bring your instruments along, and we'll all meet at the corner of Spirogyra Avenue and Paramecium Lane.

See you then!

Chemicals Protect Ruins

After years of research, scientists believe they have found a weather-proofing compound to save prehistoric pueblo ruins in the southwest from further damage by weather and erosion.

Field experiments in the past year, by Frederick T. Martius of the National Park Service, have tested a newly developed compound, consisting in part of a solution of vinyl resin in acetone and toluene. The material appears to meet the numerous requirements.

Scan Skies With Telescope

[*Continued from page* 132]

the top of the Andes, you should check for irregularities on the pitch lap. Cover the face of the mirror with a ten per cent solution of glycerin and water, then cold press the lap against the mirror. This will bring the lap back into its form. Now wash off the glycerine. Additional polishing will correct the errors in the curvature of the mirror.

To deepen the center of the mirror, take off-center strokes. Should the center become too deep, reverse the mirror and the tool and polish until the mirror is brought back to the desired curve.

After the mirror is thoroughly polished, it must be silvered. This is done in the following manner.

The mirror is first cleaned with pure nitric acid, to which a little distilled water may be added. The cleaning is done with a cotton swab on the end of a glass rod. The acid is placed on this swab. After the surface of the mirror has been carefully cleaned, it is rinsed with ordinary water. It is then rinsed again with distilled water and left in a pan of distilled water to await silvering. Do not allow any portion of the mirror to become dry between the time cleaning is begun and silvering is finished. The pan of distilled water in which the mirror is left between cleaning and silvering should contain enough water to cover the surface of the mirror completely. A Pyrex glass pie plate is ideal for this purpose.

The following is a condensed version of Brashear's method of silvering. A more complete description may be obtained by writing the U. S. Bureau of Standards at Washington, D. C.

Two solutions are needed. The first, or reducing solution, is made up as follows:

Rock Candy	90 grams
Nitric Acid (Specific Gravity 1.22)	4 cc
Alcohol	175 cc
Distilled Water	1000 cc

Make up the solution a day or so in advance. The older it is the better.

The silvering solution is made up as follows:

A Distilled Water	300 cc
Silver Nitrate	20 grams
Strongest Ammonia as may be needed (see below)	
B Distilled Water	100 cc
Caustic Potash	10 grams
C Distilled Water	30 cc
Silver Nitrate	2 grams

After all the silver nitrate has been dissolved in solution A, add the ammonia drop by drop. With the first drop, the solution will turn a thick opaque brown color. As the ammonia is added, it will clear up. Stop adding ammonia when the solution is clear. Then pour in B. The solution again will turn dark brown. Add ammonia until

[*Continued on page* 151]

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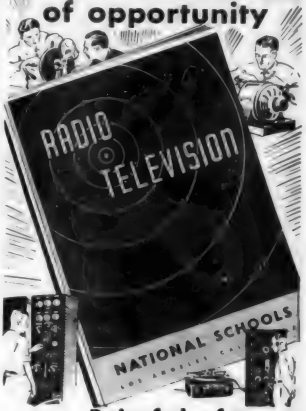

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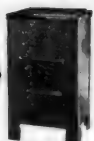

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Stamps For Specialists

[*Continued from page 71*]

nose in an Irish bog, trans-Atlantic mails have been carried, officially and unofficially, by numerous daring aviators. Special stamps have been issued for some of the flights. Even covers carried on unsuccessful trips, as witness the Hawker-Grieve attempt which finished in mid-ocean a month before the Alcock-Brown flight, are eagerly sought by collectors. Of the 182 stamps prepared for this unsuccessful attempt, one copy recently changed hands in the United States for several thousand dollars.

In the more inexpensive class are the Zeppelin covers. The greater pay-load space on dirigibles and the large number of trips which have taken place have combined to give every collector an opportunity of obtaining these flown trans-Atlantic covers, although after the fire which destroyed the Hindenburg, there was considerable fluctuation in prices. Another field is that of stamps picturing or honoring famous pilots. America's aviators have been the cause of many foreign stamp issues, which have commemorated the flights of Colonel Lindbergh, Amelia Earhart, Boyd and Lyon and others. Many are the countries which have honored their own aviators' achievemnts with stamp issues.

The engineering specialist will find more than forty types and makes of airplanes, from the Wright and Bleriot models through the Ford trimotors and Handley-Pages to the Douglas transports and Martin clippers pictured on the stamps of all nations. Such a field is worthy of a special collection in itself, while the wealth of factual background for documenting the stamp displays needs only technical knowledge and a careful selection of facts. It is this type of collection which adds more converts to the ranks of philately than the studies of plate varieties and cancellations of one single stamp, which, although of interest to experts, have a more limited appeal.

Aside from the highly popular field of aviation, the collector can develop his hobby along the more general scientific or transportation lines, or follow the strictly physical and chemical fields. From a patriotic point of view, the United States issues in these various divisions might come first. Charles A. Edison's first electric light bulb is pictured on the 1929 two-cent stamp, while Robert Fulton and his steamer Clermont were honored by the issuance of a set in 1909. Interesting additions to the steamship group would be stamps depicting an old Egyptian galley (Egypt), a Viking ship, the caravels of the time of Columbus, the Mayflower and the most recent queen of the seas to be shown on stamps, the French liner Normandie, which appears on a French stamp issued in 1935 to commemorate its maiden voyage. The railroad engineer who attempts a transportation collection can point out the difference between current day locomotives pictured on foreign stamps, the old Empire State

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Express which was used as a model of America's "Fast Express" on the two-cent value of the 1901 Pan American issue, and one of the very first trains, shown by Germany on its 1935 railroad set. The many types of locomotives, from the earliest to the streamlined, are shown on too many stamps to mention them all.

The architect will find that Austria has issued a complete set honoring seven of her prominent architects in addition to a set picturing six inventors. Switzerland commemorated the builders of the St. Gotthard Tunnel with a series of stamps. Some of the locks of the Panama Canal are shown on Panama's stamps, while bridges of all types, from ancient Roman aqueducts to the world-famous Sydney, Australia, bridge are portrayed on stamps of all nations. Andre Ampere, who developed the science of electro-dynamics, has been honored by France; Daimler and Benz, automobile pioneers, by Germany; and Galileo, the astronomer, by Italy.

The Fascist government has also commemorated Alessandro Volta, after whom the volt was named, Antonio Pacinotti, inventor of the continuous-current dynamo, and Leonardo da Vinci. Nicola Tesla, proponent of the alternating current system of electricity now universally used, is now an American citizen, but was honored by two stamps from his native country, Yugoslavia. Louis Pasteur has appeared on several French stamps in recent years.

The rate at which commemorative stamps are now issued permits nearly everyone to construct his collection along lines which interest him most. The greatest investment he must make is time. A perusal of any standard stamp catalogue will reveal a number of which might make up collections of these different types, depending upon the collector's personal preference. A study of personages pictured on the world's stamps, the historical development in a certain field—say, electricity—and the composition of the write-up to accompany the stamps adds to the philatelist's knowledge and encourages careful research. Philately has made tremendous strides since the days when stamp collecting was encouraged for youngsters because it taught them geography.

World Chemical Activity

Here are the highlights of world chemical activity as summarized by T. W. Delahanty, of the Commerce Department's Chemical Division:

Germany has a seasickness remedy and an improved diphtheria vaccine.

Japan has developed a smallpox vaccine and a sleeping sickness serum.

India has produced a snake venom treatment for cholera.

Czechoslovakia is extracting narcotics from empty poppy heads.

England has built the first factory for the manufacture of synthetic vitamins on a large scale.

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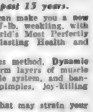

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Shelter Tents For The Hiker

[*Continued from page 67*]

Forester tents are erected by means of two frontal shear poles, and one long backward sloping ridge pole. A tent of this sort is all right for use in a wooded country where it is a matter of ease to obtain shear poles, especially a ridge pole 12 feet in length. While the Forester with its open front is so made that it will admit a fire in front to throw the heat inward, and is, therefore, a cool-weather tent, it can also have its front closed in with bobbinet, mosquito netting or cheese-cloth to shut out the insects in the summer. It should be understood that the Forester tent, at 3½ pounds weight, does not include a sewed-in floor cloth or canvas, both of which items would necessarily add to the weight. The Forester tent, nevertheless, is one of the best recommendations in the shelter tent field.

Two features connected with shelter tents must be given due consideration. First, is the bobbinet or protected front and second is the sewed-in floor canvas. There are some who object to the bobbinet material, believing its screen too open, admitting minute insects, particularly sand flies and "no-see-ums." There is much truth to this. Those who object to the bobbinet as being ineffective will find that a high-grade cheese-cloth is successful and far more reasonable in price. It should be sewed along both sides of the inside of the opening of the tent and by being free and full, need not be cut down the center. To enter the tent merely lift up the cheese cloth, enter the tent and drop the cloth down after you.

To cut down on weight, the go-light hiker invariably does without the sewed-in floor canvas. Doing so, he takes away from the tent one of its most desirable features. For one thing, the floor canvas removes one from actual direct contact with the earth and eliminates dirt and insects as well. Often when a tent is placed on the ground it will entrap insects caught on the spot and these will come up into the tent. With a floor cloth or canvas sewed in, the tent will be like a bag, and dirt and insects will be left outside. Added to the above, by having the floor sewed in it may be stretched to the same points all around when the tent is pegged down. Without the sewed-in floor canvas the tent is never stretched to the same points each time it is erected.

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The spot you pick to erect your tent is very important. Many a grassy place in a gully looks inviting, but it may be in the path of a freshet in case of a heavy rain. Select a spot, if possible, that has drainage to all sides. You are then safe in any weather.

In threatening weather do not place your tent under large trees. Lightning may strike or a wind-storm may topple trees over on you. It is better to place your tent in a protected thicket

[*Continued on page 150*]

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Shown above is the smallest railway in Canada. Operated by Professor William Rowan, head of the Department of Zoology at the University of Alberta, the miniature railway is located in Jasper National Park. Featuring both passenger and freight cars, the "road" is known as the Lake Edith Railway Company.

(Photo—Canadian National Railways)

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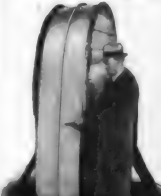
Conveyor Belt Has Center-Guide



This conveyor belt has a molded continuous guide strip on its underside. Anti-friction conveyor idlers having a central roll with a deep groove within which the guide strip is confined are used with the new belting. In operation, the belt is said to maintain its central carrying position at all times, even when the conveyor is tilted sidewise at a considerable angle.

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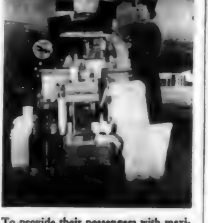

To provide their passengers with maximum comfort and convenience, modern transport planes carry as many as 1,200 items such as:—a typewriter, silver service, china service, food containers, electric shavers, etc. (Photo courtesy of American Airlines, Inc.)

Students Sail Boats

Small boat sailing has become the most popular student activity at Massachusetts Institute of Technology located at Cambridge, Mass., and this dinghy makes a pretty picture as it approaches the camera head-on. The Institute maintains a fleet of 38 sailing dinghies.

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Device Records Air "Bumps"

"Bumps," or gusts of wind, are measured and studied by a new device devised by experts of the National Advisory Committee for Aeronautics at their laboratories located at Langley Field, Va.

The bump recording instrument is small enough to fit into a suit pocket. About 160 of these instruments are placed in airplanes and seaplanes of different types during actual flight. One of them has been carried by the China Clipper on round trips between San Francisco and Manila. From the curve traced by the instrument, engineers are able to reconstruct every roughness of the voyage and tell what stresses the craft withstood throughout the trip.

Gusts are made to order in a new tunnel and model airplanes are catapulted into them. As fast as an arrow is shot from a bow, the tiny plane is accelerated to 50 miles per hour in a few feet of travel. Hit by the gust, its action is recorded by a motion picture camera for detailed study and observation.

The Chinese are credited by tradition with knowing something of terrestrial magnetism and electricity 2,500 years before the beginning of the Christian era.

Government food and drug officials warn that lye should be kept out of a child's reach, because lye is poison causing acute suffering or death if swallowed.

Novel Wind Tunnel Devised

Miniature airplanes take off and maneuver for the sake of science in the world's first "free-flight" wind tunnel demonstrated for the first time by the National Advisory Committee for Aeronautics in its extensive laboratories at Langley Field, Virginia.

Instead of the small counterpart of a full-sized airplane being held conventionally in an experimental blast of air, the artificial breeze is increased until the model takes off by itself and flies freely. The ailerons and rudder are controlled by magnetic fields acting on small electro-magnets in the model's wings. The scientist in charge maneuvers the test model plane just as a pilot handles a real one.

"We expect that this new method of studying airplane stability and control will give us much information directly that we have hitherto obtained theoretically or by empirical estimation," said Dr. George W. Lewis, N. A. C. A. director of research at the laboratory.

Stone tools and other relics of a tribe of Old Stone Age hunters in Europe have been given to Mount Holyoke College in Massachusetts by the National Museum in Budapest.

Many of the best preserved plant fossils in western North America are found buried in volcanic ash which has been compacted through the ages into solid rock, says a paleontologist.

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Shelter Tents For The Hiker

[Continued from page 142]

with trees of a young growth up to six inches or so in diameter and around twenty feet in height. Such trees rarely blow down and assure ideal shelter.

Learn to erect your tent in several ways, as for instance, by means of shear poles; a rope stretched between two trees; or by a rope from the tent peak up to the branch of a tree above the tent. The poles should invariably be outside for maximum comfort.

Always in erecting your tent see that the ground is higher at the head where you are to sleep. Too often this is not taken into consideration.

A goose feather pillow weighs next to nothing and adds immeasurably to your comfort at night. It can be compressed into the packsack to take up little space. Pneumatic pillows are also an idea well worth looking into.

A balsam bed of small twigs will add much comfort. Nothing quite exceeds the ozone of the balsam as a sleep producer.

If your shelter tent possesses no sewed-in floor canvas and you have to lay down a piece of separate canvas, you may be interested in using an army poncho, procurable in most army stores. It is to be preferred to a canvas floor cloth in that it prevents moisture from coming up through. Aside from this, the poncho makes an excellent rain-cape, table-cloth in the open, or something to sit on.

Artists Blow Glass Bottles

[Continued from page 120]

allowed to cool naturally the way they are, they would break at the slightest touch of a human hand! The "lehr" is a machine which literally bathes each bottle in a stream of fire. A row slides down, rests over the flames an instant, and is whisked into the maw of a long, tunnel-like affair.

In soldierly fashion, the bottles now march slowly through the long length of the lehr, experiencing throughout varying degrees of heat. Finally, they emerge from the opposite end in a cool, bright room, where neatly uniformed girls lift them from the conveyor, inspect them, and pack them into corrugated cartons.

As you watch the thousands upon thousands of bottles parading from the finishing end of the many lehrs (there are thirty machines in this particular plant) you are forced to smile at your first idea of bottle-making. It would certainly take a lot of lung-power to blow up all of these bottles, as the old-timers did, once upon a time!

A laboratory in a trailer is being used by government scientists to study insect pests in southern peach orchards.

Accept No Substitutes! Always Insist on the Advertised Brand!

Scan Skies With Telescope

[*Continued from page* 139]

it becomes a light straw color and is transparent. Now add as much of C as the solution will take. Stir constantly. Do not stop until there is quite a bit of matter suspended in the solution and it will take no more. Then filter through absorbent cotton.

Now add about 6 cc of the reducing solution for each gram of silver nitrate used. Pour the mixture on to the mirror where it is lying in the water. The water need not be removed. Keep the solution in motion during silvering, which will require 3 to 8 minutes.

The mirror is now set up to dry. It should be allowed to dry for two days. After it is dry, it must be burnished with a pad made from the finest chamois wrapped around some cotton. A little of the finest optical rouge is used, and the mirror polished with circular strokes. It should be dusted occasionally during the process, to prevent scratching.

The polishing should be done and the solutions kept at a temperature of not more than 64° Fahrenheit.

The mirror is now ready for mounting, which will be discussed in the third and final article of this series.

Sand For Auto Wheels

An automobile sanding device intended to prevent autos from skidding on wet, snow-covered or icy streets, in much the same manner as sand is used by street cars, is described in a patent granted to J. S. Feins, a New York inventor.

Every time the driver pulls up his emergency brake, or steps on the foot brake, the patented automobile sander would immediately sprinkle a copious supply of sand on the highway beneath the rear wheels of the auto to provide a good, non-slipping surface.

Swung like a battery from the floor of the car, the sander is a box-like container with a grate-like bottom and a hinged top for refilling purposes. A nozzle extends from the bottom and sprinkles sand below the rear wheels, each of which has its own individual sander.

A grated sliding plate in the sand box, placed just above the grate-like bottom, is held in closed position by a spring and no sand normally can flow out of the box.

The sliding plate in each sand box is connected by a long Y-shaped rod, either to the foot brake, emergency brake or to a special lever so that when the driver of the car steps on the brake, pulls up the emergency or operates the lever, the sliding plates simultaneously move to the open position. Sand now pours out through the nozzles which sprinkle it beneath the wheels.

When the streets aren't wet or snow covered, the sanding device can be disconnected.

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Engineer Lauds Geophysical Prospecting Methods

THE modern geophysical prospecting methods of science, which use electricity and magnetism instead of a forked branch of a tree to detect the presence of valuable ore deposits, are the way mining engineers are outwitting the obscuring blanket of rocks and earth which the great glacial invasions threw over the earth tens of thousands of years ago.

In Canada, in particular, the method finds wide usefulness and its greatest development. Hans Lundberg, noted Swedish engineer who has pioneered in the use of the equipment, pointed out that most of Canada's great mineral wealth has been, in the past, discovered by geologists who prospect on the indications of surface rocks and their formation. And this, he added, despite the fact that almost 99 per cent of Canada's visible terrain is a layer of glacial deposits from a few feet to 120 and more thick. It is the method of geophysical prospecting which allows science to penetrate beneath this overlying glacial drift layer and tell what the real nature of the bedrock below may be like.

"Since the rich ore deposits known in Canada," said Mr. Lundberg, "are found in the one per cent of the country where they are visible, it is logical to assume that there must exist valuable and rich ore bodies in the 99 per cent of the country where they are not visible, and we know that the geological conditions must be similar. Geophysical prospecting serves to supplement the findings of a geologist, in quite the same way that X-ray studies add to the knowledge of a surgeon."

Typical of success last year, declared Mr. Lundberg, were surveys made in British Columbia where, for a cost of $6,000, deposits were found which in six weeks yielded gold ore valued at a million dollars. The same company in the previous year had spent $60,000 in prospecting to find deposits of a similar value.

A method has been developed whereby seedling grapes of certain varieties may reach the fruit-bearing stage in 18 months, instead of four or five years.

Drought is blamed as the main reason for locust plagues in China, by one Chinese scientist who checked droughts and locust records back 300 years.

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A portable electric blower supplying air at a 176-mile an hour rate.

A portable drawing machine mounted on a light weight sturdy board. Protractor and scales have a flat silver finish with black filled etched graduations.

An inter-office communicating system having a central station and one to four substation units.

A golf recorder offers first aid to the golfer developing his swing. It records every shot as it is made.

A smokeless, drippless and easily refilled candle which will not bend in hot weather.

A welding helmet of one-piece tough black vulcanized fibre.

A room cooler using ice. One filling lasts four to six hours.

A safety, non-sparking wrench, drop forged from Beryllium copper.

A wood golf tee claimed to be unbreakable.

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A laboratory mixer for very viscous and sticky liquids.

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